AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

MAY, 1959

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Precision Metal Molding

PMM

INCLUDING DIE CASTINGS' MAGAZINE

DIE CASTINGS

EXTRUSIONS

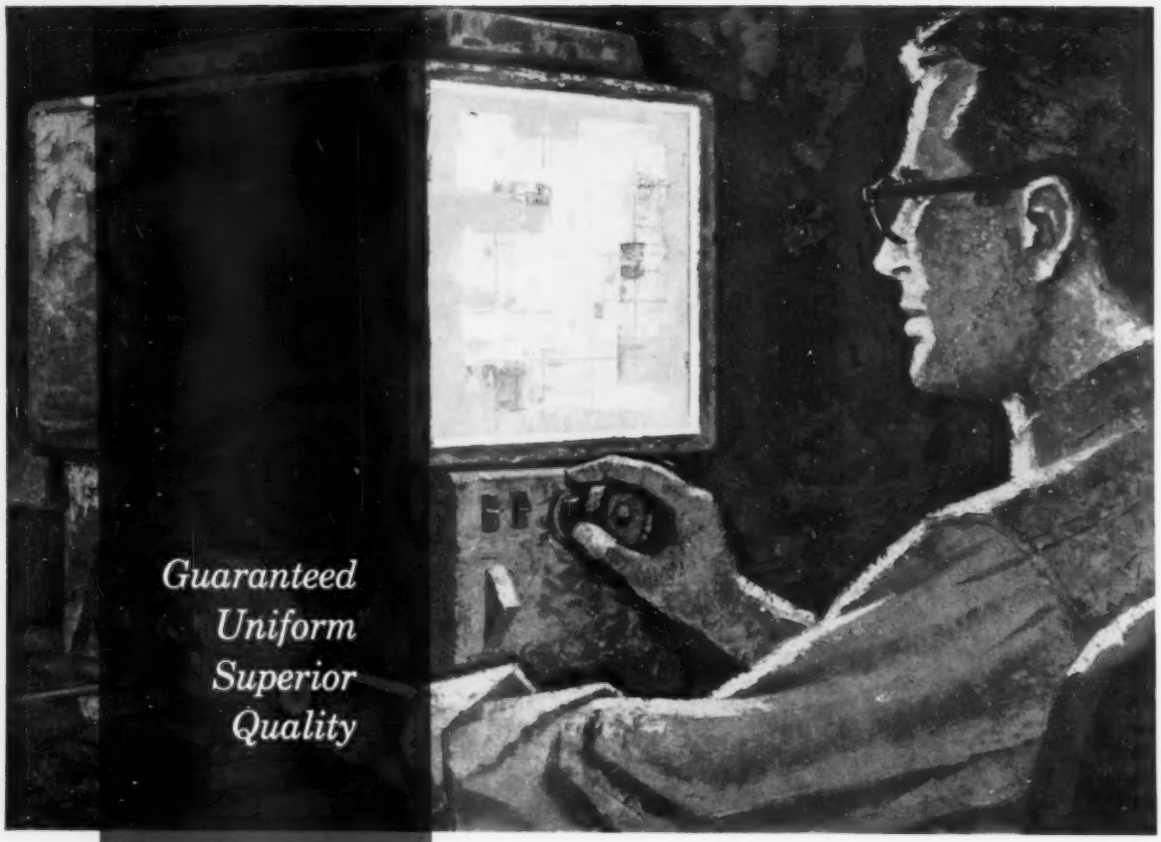
INVESTMENT CASTINGS

RMANENT MOLD CASTINGS

PLASTER MOLD CASTINGS

SINTERINGS

SHELL MOLD CASTINGS



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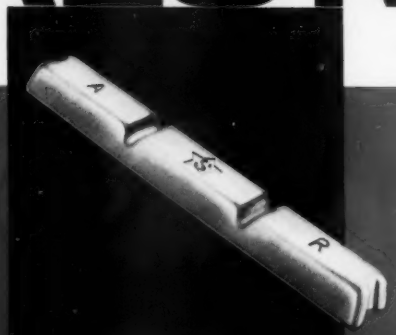

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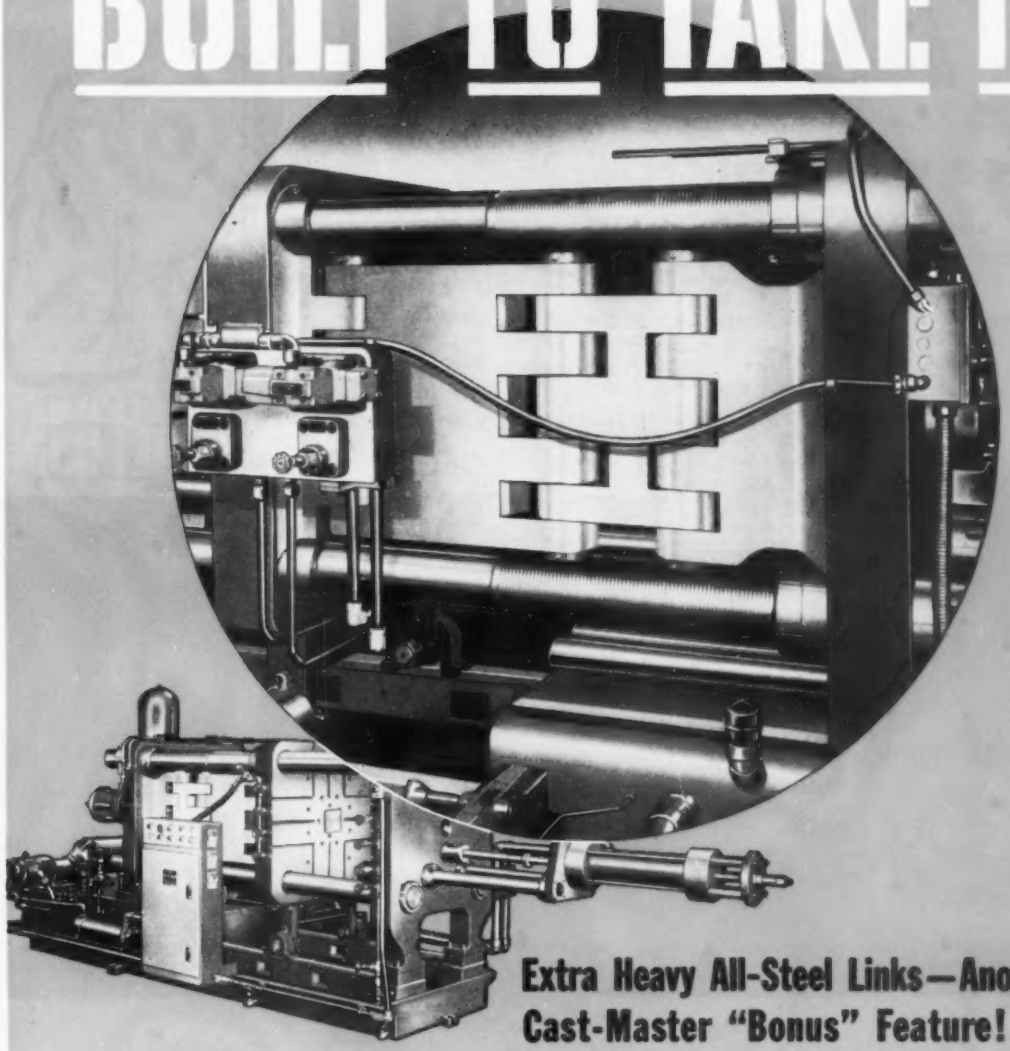

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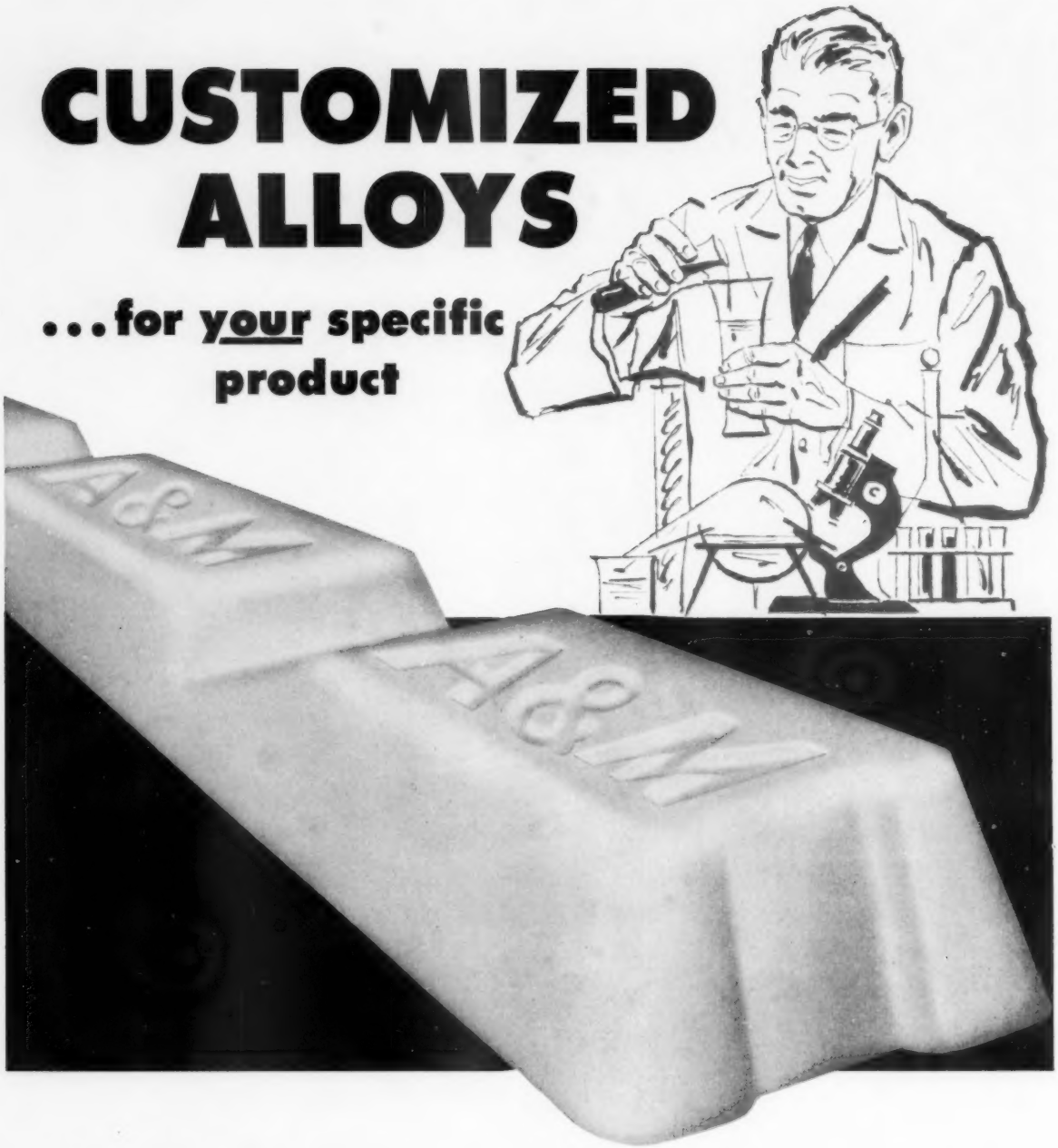

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PMM **IN THIS ISSUE** May, 1959: Volume 17 Number 5

COVER

THE DIE IS THE KEY — an often repeated remark which is almost as often wrong. Skilled tool and die making is an essential in any industry that forms metal to precise dimensions, but a poor design remains poor regardless of the skill of the die maker. Start with the right alloy to give the mechanical and physical properties that are needed. Add to this sound engineering design tailored to the process you're going to use to make the part. You will end up with the best possible part at the lowest possible cost. The material presented in this issue (starting on page 39) will give you some basic design information. Couple this with the physical and mechanical data given last month for a basic design package.

FEATURE ARTICLES

39 DESIGNING FOR ALUMINUM DIE CASTING
Broadly, die casting design is much the same for all of the commonly cast metals. But each one has a few points of difference. Here are some design tips that are almost specific for aluminum die castings.

41 DESIGNING FOR ZINC DIE CASTING
There are a lot of things you can do with zinc base alloys and some you shouldn't do. This article will be a guide to them.

44 DESIGN POINTERS FOR DIE CASTING
Six pages of good and bad design. Shows what to do, what to avoid.

50 DESIGNING FOR INVESTMENT CASTING
Get better investment castings at lower costs and show your foundryman a bit of mercy by using good design practice.

52 DESIGN POINTERS FOR INVESTMENT CASTING
Things to do and things to avoid are shown graphically on these four pages of design tips.

56 DESIGNING FOR PERMANENT MOLD CASTING
One of the most versatile casting methods, permanent mold casting can solve a lot of problems – if your design is right. Here are some helps.

58 DESIGN POINTERS FOR PERMANENT MOLD CASTING
Two pages of graphic design aids which are specific for permanent mold casting.

60 DESIGN POINTERS FOR POWDER METALLURGY
Four pages which show the correct and incorrect designs for parts to be made from metal powders.

64 DESIGNING FOR PLASTER MOLD CASTING
A practical foundryman who specializes in plaster mold casting tells how to design for the best possible cast parts.

67 PROPERTIES OF FERROUS EXTRUSIONS
No. XI in a series on the properties of extruded metals. This month some of the commonly extruded steels are covered.

68 DESIGNING FOR STEEL EXTRUSIONS
Many designers who are quite familiar with non-ferrous extrusions don't know how satisfactory and inexpensive ferrous extrusions can be.

71 DESIGN TIPS
This month we give tips on standard dimensioning and tolerances for non-ferrous extrusions.

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74 NUMERICAL TAPE CONTROLLED MACHINING
Here's a machine control method which carries the cost savings of high speed production methods into the machine shop.

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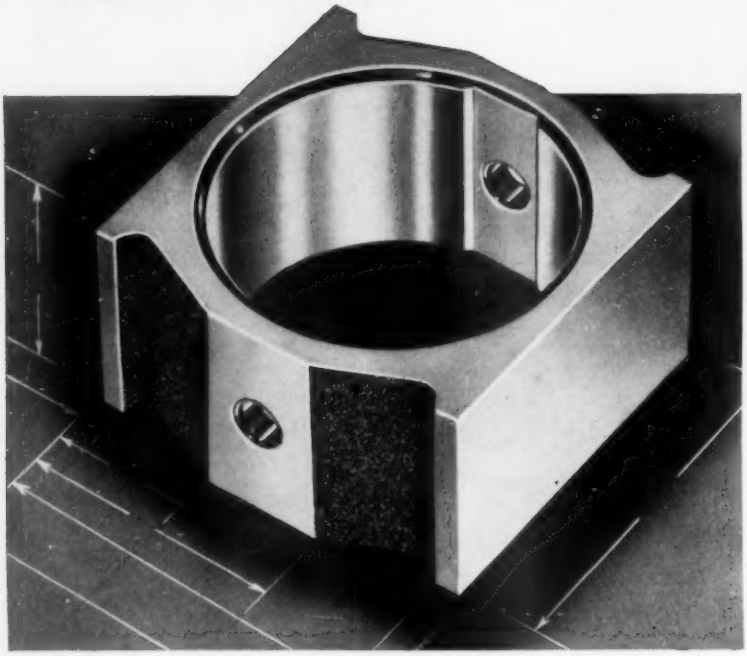
many difficult requirements...



We illustrate the cast bronze cam block for a hydraulic pump operating the hydraulic lift mechanism on an exceedingly well-known line of farm tractors.

The manufacturer of this equipment has very unusual specifications for this cam block. Its bore has a very fine finish specification. It also must be round and true to size within unusually close limits. In addition, it must be square to the face of the cam block within limits that ordinary methods of manufacture will not attain.

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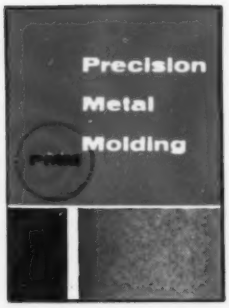

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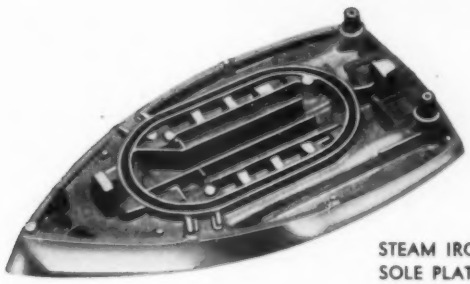

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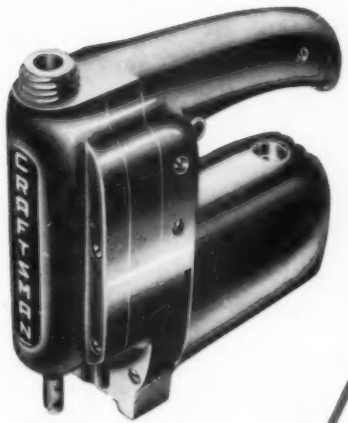

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Shown are typical vacuum die castings (we produce steam iron sole plates for six leading manufacturers).

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SEND FOR LITERATURE AND FURTHER DETAILS.

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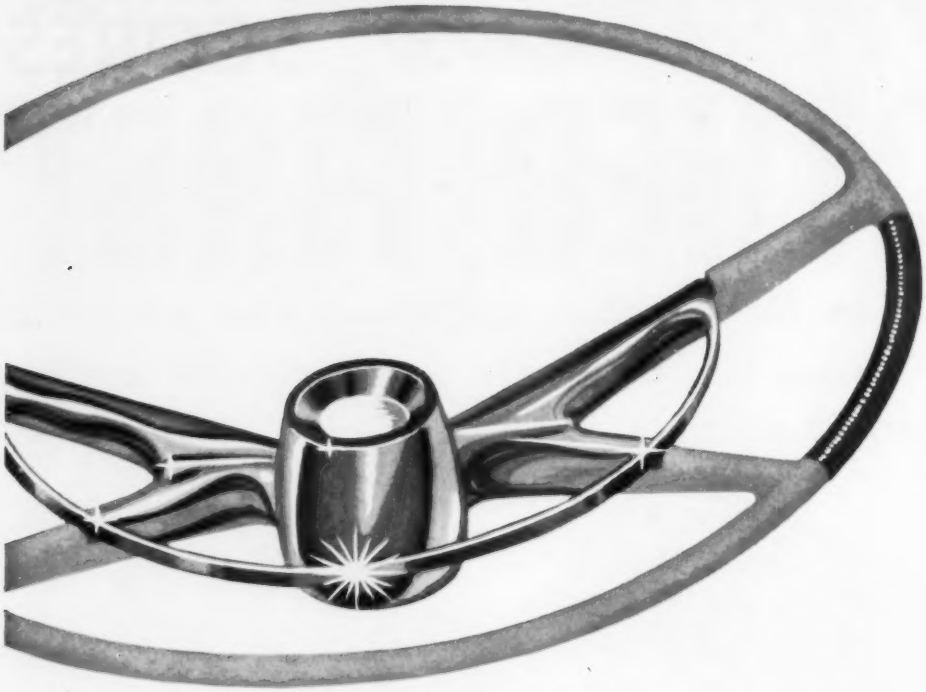

specify TADANAC zinc

The gleaming horn ring of a modern automobile is both functional and ornamental. It is also one of the many parts of today's cars made from die-cast zinc. For the very best in die-casting zincs, specify TADANAC BRAND — or alloys made from it.

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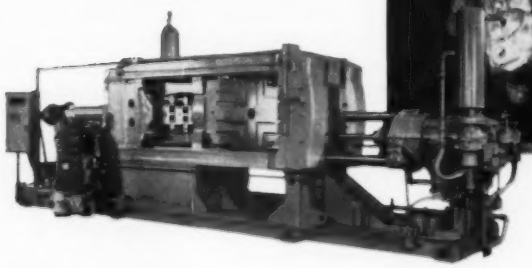
OUR DIES WOULDN'T RUN ON ANYTHING BUT LESTERS...

WE TRIED... AND FOUND OUT!

says: MILTON R. HOEPPNER
Administrative Assistant
McCulloch Corporation
Los Angeles, California



"Orders were building up for our largest outboard motor die castings, so we decided to step up production by farming out the dies for the aluminum castings. It was a good idea except for one thing—no one else in this area owned an 800 Ton Lester—the kind we were using to cast the 30 lb. block for the motor.

"Without the Lester, they just couldn't give us comparable quality—the kind we demand for our products. As a direct result, *we* ordered more Lesters. In fact, two of them are 1000 Ton machines, with bigger platens and more speed and pressure, so we'll be able to make even better parts ourselves. By July, 1959, we'll have nine Lesters, ranging from 600 to 1000 ton clamp, running at McCulloch Motors."

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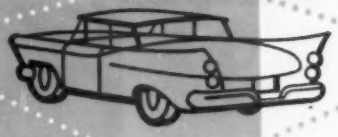

save production time lower costs and improve product performance

This two unit assembly, produced by the American Sinteel Corporation, is the control mechanism used on the reclining seats of a 1959 automobile. It is an excellent example of how a multitude of desirable features can be incorporated into a powdered metal part.

This pump rotor with its seven "slippers" is employed in the automatic transmission of an automobile. Because of its complex design, it was a difficult and costly part to produce by conventional methods. American Sinteel engineers were able to solve the problems involved and now the part is being produced on a production basis at a low unit cost.

Low cost, high speed production, close tolerances and unusual design possibilities are among the many advantages of Sinteel powdered metal parts. There are literally thousands of applications, including such products as gears, cams, complex nuts and fasteners, special purpose filters and structural members from steel, iron, brass and copper alloys, where Sinteel powdered metal parts can improve the performance of products now being made by other, more expensive methods of manufacturing. Powdered metal parts are available with many special characteristics, including self-lubrication, controlled porosity for infiltration and good electrical and magnetic properties for pole pieces, armatures and cores. Whatever your product requirements are, American Sinteel Corporation can produce precision parts to your specifications at substantial savings.

For more information on Sinteel ferrous and non-ferrous powdered metal products, send for your free copy of Engineering Bulletin #3020. It contains valuable information on Sinteel alloys and designing for Sinteel powdered metal products. ▶

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LETTERS

the readers' forum

EDUCATION PLEASE

In October of this year, we plan to have a die casting machine, a shell molding machine and do some investment casting. As we have done only sand casting in the past, we have no experience in the operation of any of these forms of molding.

I would appreciate it very much if you could tell me where I could get literature on the operation and equipment needed in these forms of casting. – G. J. McK, Instructor in Mechanical Eng.

The machine builders, metal suppliers and trade literature are all fruitful sources of information of the sort this reader needs. A list of sources has been sent. – ed.

STOCK DIES

We are interested in purchasing zinc die cast, oval shape valve or stop handles. Will you please inform us of a company that makes this handle as a stock item. – H. A. G., president.

We maintain a file of die casting companies who own dies from which they make stock items. This reader was referred to three companies who make the type handle he wants. – ed.

METAL PROTECTION

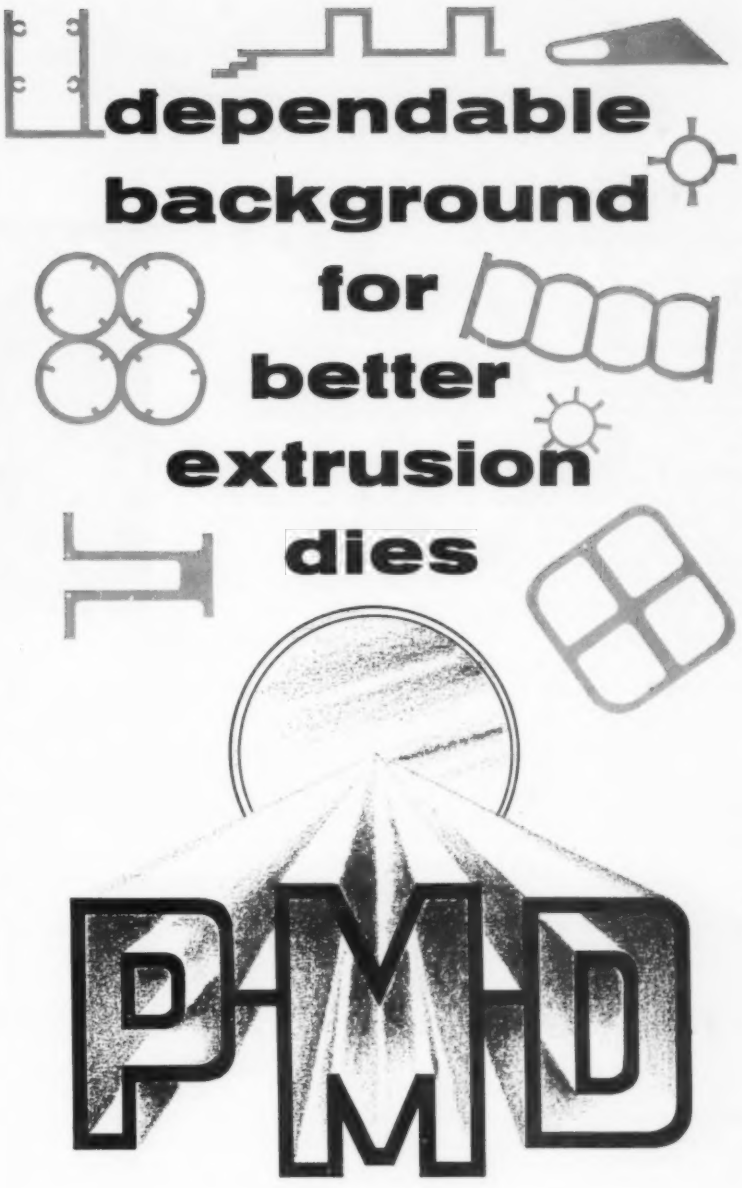
Here in Germanu there are various kinds of insulation against acids and alkalies but they are not durable enough to use with hot solvents such as perchloroethylene or trichloroethylene.

We need a material which will resist a 2 to 3 minute dip in perchloroethylene at 119°C. Can you furnish us with the names of companies who can furnish an adequate insulator. – Presta Metallwerk G.m.b.H.

This reader has been referred to companies who, we believe, can furnish a suitable coating material.

PERFORATIONS

The perforated sheets in your magazine deserve a note of appreciation. The tear out sheets have proven very helpful in passing along articles to other members of our organization and in my opinion should be incorporated in other magazines. – R. W., Sup't.



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CAST EXTRUSION DIES—are now available at PMD, for extruding brass, copper, steel alloys, and rare earth metals. Leading extruders agree that these cast dies have longer life and give them closer tolerances, better performance, lower tooling costs.

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CASTING ABOUT

technical news of applications & processes involving precision metal moldings

LARGE BERYLLIUM SHAPES are now being made by closed die forging. A new technique developed by the Wyman-Gordon Co. overcomes the inherent brittleness of beryllium and allows production of aircraft and missile components without the expensive and wasteful machining from sintered blocks which has been necessary in the past.

For space and missile applications, beryllium has a number of outstanding advantages. It's as light as magnesium, has a modulus of elasticity one and one-half times that of steel and an excellent strength-to-weight ratio.

The importance of weight saving in space travel is best appreciated when the possible reduction in weight is translated into pounds of fuel. By using beryllium in the last stage of a three-stage rocket, a saving of 400 pounds in the third stage can be made. This means that 2,000 lbs. less fuel is needed for third stage propulsion. When this 2,000 pounds is carried through it means 200,000 pounds of fuel at launching. The result, materially increased range for the same fuel load.

THE LARGEST COLUMBIUM INGOT ever cast has been made by the Wah Chang Corp. and Universal-Cyclops Steel Corp., it weighs 500 lbs.

Four inch diameter columbium-zirconium ingots were produced by the Wah Chang Corp. in their Albany, Oregon plant and shipped to Universal-Cyclops for casting. Casting was done from an arc furnace which melted the metal and cast it without altering the composition or characteristics of the metal.

Columbium and columbium base alloys are becoming important because of the high melting point of the metal, 4500°F, and its resistance to corrosion. Good high temperature, high strength alloys can be made from the metal. Vacuum and electron beam melted ingots, sintered ingots, powder and fabricated shapes are now being made from either the pure metal or from columbium base alloys.

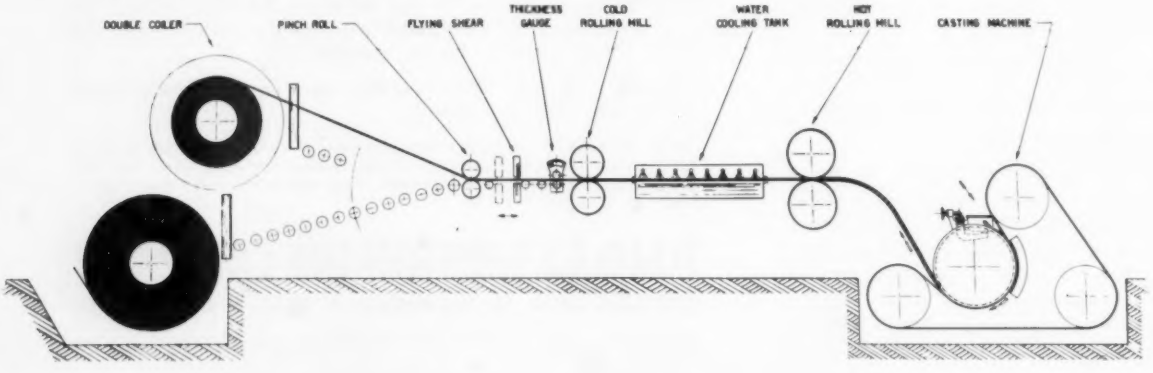
LARGE SCALE USE OF SINTERED NICKEL can result from development work started by American Motors Corp. and the Sonotone Corp. They're investigating the possibility of an electric automobile. It will be powered by a sintered-plate, nickel-cadmium battery.

Present plans call for investigation of a power plant which will have an engine driven generator to continuously recharge the batteries. The main advantages of the nickel-cadmium battery is that it can withstand great overloads and can be recharged in a fraction of the time of conventional batteries. Life expectancy of the battery should be as long as the balance of the automobile.

IMPACT EXTRUSION of aluminum may get a price advantage from a new continuous casting and rolling machine developed by Lobeck Casting Processes, Inc.

The new process can be a production line operation similar to any machine tool. One complete, integrated piece of equipment starts with ingot or scrap and produces strip of specified width and thickness. The new method offers the advantages of lower raw material costs, process scrap recirculation, reduced metal inventory, faster strip availability and improved strip quality.

While coiled strip may be produced, for impact extrusion the cold rolled strip can go directly to blanking presses to form the extrusion slugs. One installation produces ⅛" x 8" type 3003 strip at a continuous rate of about 4 tons per hour. All process scrap is immediately recirculated to the melting furnace at the head of the line.



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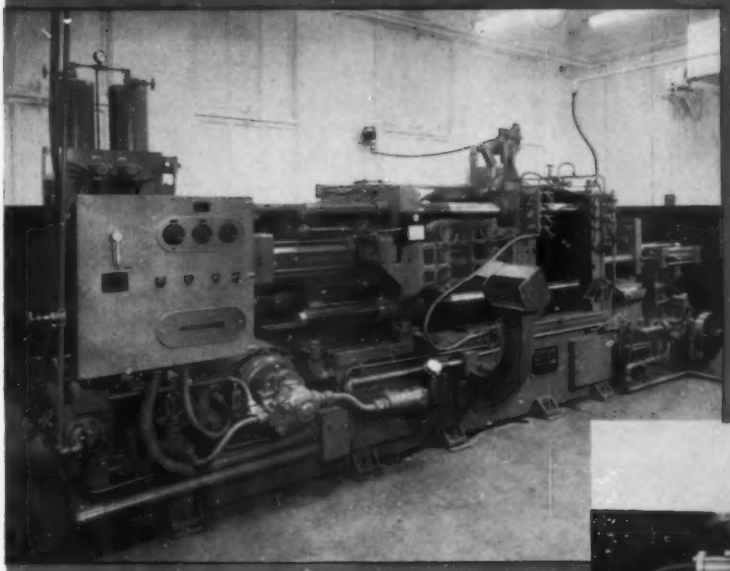

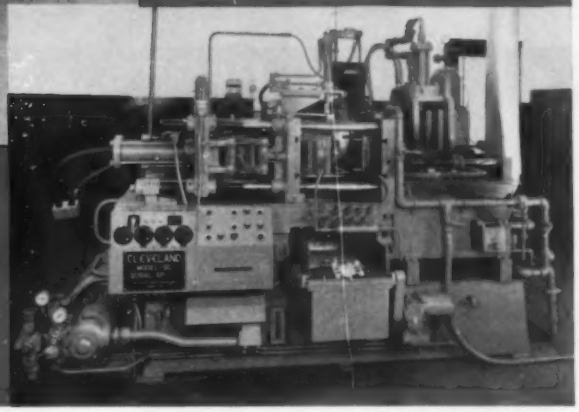

In Cleveland's Die Casting Development Center are a fully automated 50-ton Cleveland (right) producing a multiple-cavity zinc casting on an around-the-clock, 7-second casting cycle, and a 400-ton Cleveland (above) that incorporates vacuum die evacuation and advanced features for aluminum die casting.

Extensive work in Cleveland's Die Casting Development Center has produced the industry's most advanced engineering of **vacuum die evacuation** and **full automation.*** Equally important, these developments carry **most modest price tags!**

**Other important die casting development work is in progress*

Shown above are a Cleveland Model 50 Zinc Machine and a Model 400-N Aluminum Machine that incorporate these and many other advanced engineering features. These two machines are now in operation in our plant. Call in a Cleveland field engineer. Let him provide you with full details and schedule your visit to see these machines in action.

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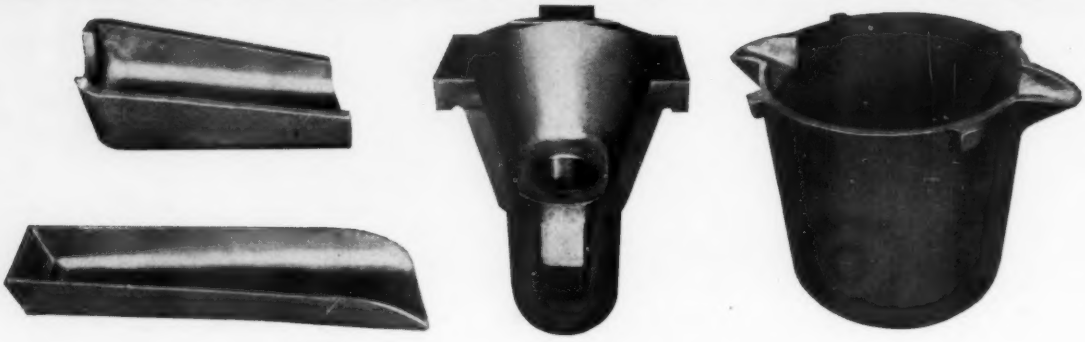

Here's another industry first! Dodge now offers an *individualized* service for the manufacture of a wide variety of die-casting parts and accessories, each *custom-made* of long-lasting steel. If your needs include goosenecks, interliner and melting pots, pouring spouts, plunger pullers, chutes, pistons, tapered nozzles, skimming pots, etc., we'd be happy to quote on your requirements. How may we be of service?

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6501 Tacony Street • Philadelphia 35, Pa.

THE MOST IMPORTANT ALLOY IN A STEEL CASTING IS QUALITY

For more information circle No. 25 on the Reader Service Card

after 30 years of serving the die casting industry in finishing we NOW offer you a complete die casting service

SEND FOR FREE BOOKLET

Take a tour of our modern plant by means of this well-illustrated booklet that shows our facilities for making and plating your die castings.

THE DISALLE PLATING & DIE CASTING CO, INC.
2851 SOUTH AVENUE • TOLEDO 9, OHIO

I am interested in learning more about your ability to produce and finish die castings for me. Please send me your photographic booklet showing your complete facilities without obligation.

Name _____

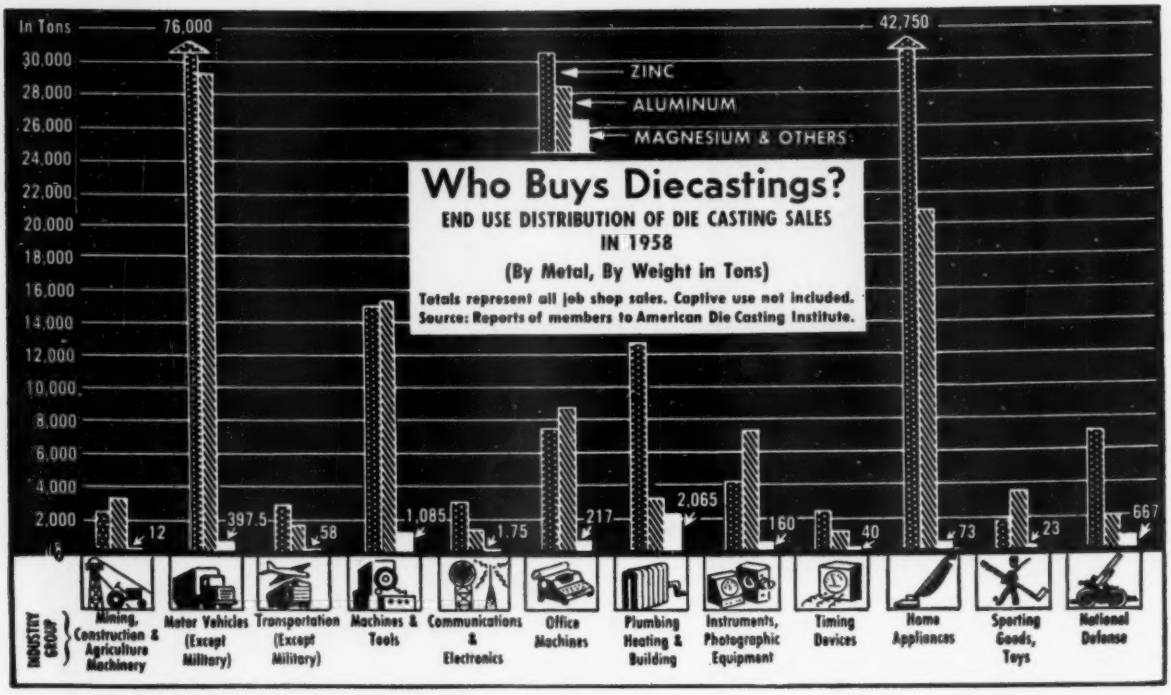
Title _____

Company _____

Address _____

City _____ Zone ____ State _____

For more information circle No. 22 on the Reader Service Card



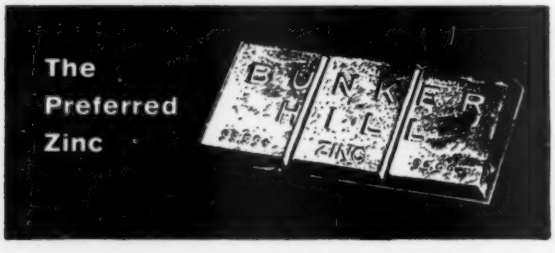
these industries do!

Applications of zinc base die castings are steadily becoming more varied and more widespread. Today, it would be virtually impossible for anyone to go through an ordinary day's routine of living without using—directly or indirectly—an immense number of appliances, devices and services in which zinc alloy die castings form essential parts. The chart above shows sales by job shop die casters in 1958. The superior physical characteristics of zinc as a base metal for die castings is indicated by the fact that in 1958 67% of all die castings by weight, sold by job shops, were based on zinc.

Die Casting . . . the shortest distance between raw material and finished product . . . is the second largest consumer of zinc and is continuing to expand because of industry's recognition of what the process has proved itself to be: One of the fastest and most economical production techniques at the command of the metalworking industry today.

DIECASTING is the Process.. ZINC, the Metal

BUNKER HILL



BUNKER HILL 99.99+% ZINC

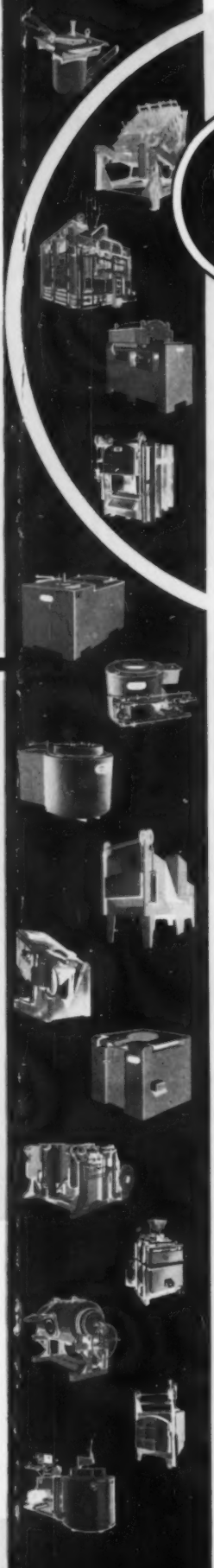
Eastern Sales Agents

ST. JOSEPH LEAD COMPANY, 250 PARK AVENUE, NEW YORK 17

Sales Office For Pacific Coast

THE BUNKER HILL CO., 680 MARKET STREET, SAN FRANCISCO 4, CALIF.

ZH-128



LINDBERG
FISHER

This nameplate is on all the equipment anyone needs for melting and holding aluminum

Heat and aluminum have been Lindberg's babies for many years. If your product requires the application of heat to aluminum anywhere along the line, we can help you do the job. Lindberg-Fisher furnaces cover every requirement of "heat for aluminum" and embody the latest developments in the field. Many new design and engineering features make Lindberg-Fisher melting and holding furnaces, and accessories, the most modern equipment available to industry.

With Lindberg-Fisher furnaces too, you get the expert technical skills of Lindberg Engineering Company's staff of engineers, metallurgists, technicians, widely experienced in all phases of aluminum melting, casting and treating. Because Lindberg builds all kinds of melting equipment, gas—oil—electric (resistance, 60 cycle induction, arc, or high frequency) . . . we can intelligently and objectively recommend the proper type of furnace to suit your particular conditions and needs.

We can fit the latest melting and holding equipment into your production line efficiently and economically—helping you to manufacture your product to closer specifications, and at a lower cost. Consult your local Lindberg representative. You'll find him listed in the local classified telephone directories in major industrial areas.

Lindberg-Fisher Division, Lindberg Engineering Company, 2463 West Hubbard Street, Chicago 12, Illinois. Los Angeles plant, 11937 South Regentview Ave., at Downey, Calif. In Canada, EFCO-Lindberg, Ltd., Toronto.
Also factories in: Argentina, Australia, England, France, Germany, Italy, Japan, Scotland, South Africa, Spain and Switzerland.

On the following two pages we've illustrated and described the Lindberg-Fisher equipment that covers all your "heat for aluminum" needs. Will you please turn the page?

LINDBERG heat for industry

FROM THE VERY BEGINNING

Starting with alloyed ingot or molten metal delivery from the reduction cells, aluminum can be processed in a wide selection of furnaces.

In Melting and Holding Furnaces

As shown in the flow diagram molten aluminum is delivered to either large capacity fuel fired reverberatory furnaces, or tilting two chamber induction furnaces for storage at suitable temperature . . . or alloyed ingot is melted and stored in similar furnaces . . . to provide an adequate supply of molten aluminum for the casting station area furnaces.

In Casting Station Furnaces

Molten metal received from the large storage or breakdown furnace described above or from smaller melting furnaces—again either fuel fired or electric, is received at the casting area, maintained at the correct temperature and processed into desired castings. Most of the holding furnaces illustrated can also be used for melting.

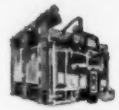
Many of the casting station furnaces shown can be equipped with the Lindberg-Fisher Autoladle for automatic ladling or hand ladling.

Hot Metal Delivery

Ingot

Fuel fired reverberatory, melting or holding. Charging well optional.

60 cycle two chamber induction, tilting; melting or holding.



Fuel fired, double reverberatory melting and holding. Especially suitable for alloying. Charging well optional.

60 cycle, two chamber induction, tilting; melting and holding.

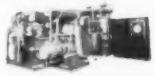
60 cycle induction coreless, tilting, especially for melting chips.

Fuel fired, crucible or pot, tilting, melting.

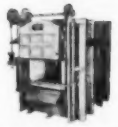
Electric resistance, "radiant muffle," Dry-Hearth, melting and holding, nitrogen atmosphere, especially for insert scrap.

High frequency induction, tilting, melting.

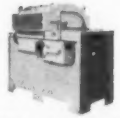
Autoladle for automatic ladling, four standard sizes available, up to 100 lbs.



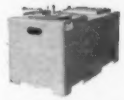
HYNI generator, low cost, high purity dry nitrogen.



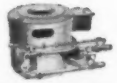
Fuel fired reverberatory, holding or melting.



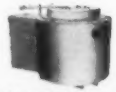
Electric resistance, "radiant dome," reverberatory, holding.



60 cycle, two chamber induction, holding or melting, stationary.



Fuel fired crucible or pot, holding or melting, stationary.



Electric resistance, crucible or pot, holding or melting, stationary.

Fuel fired, Dry-Hearth, two chamber, holding and melting.

WHEREVER ALUMINUM NEEDS HEAT, LINDBERG

A unique innovation is the Lindberg HYNI Generator... which supplies dry, high purity nitrogen economically, as a protective atmosphere for both melting and holding applications.

In Remelting Furnaces

As the castings move out of the casting area for trimming, machining and finishing, the gates, risers, sprues, chips and scrap castings, etc., are returned to a remelt operation in one of the furnaces shown on the far right. These furnaces can be used for ingot meltings as well as for remelt operation.

In Heat Treating Furnaces

From the trimming and sorting station some castings are ready for direct use, others require suitable heat treatment as shown.

TO THE FINAL PRODUCTS

Lindberg can provide ANY furnace for your needs.

Fuel fired, Simplex, rotary, horizontal, drum, melting.

Continuous casting machine, rounds and polygons.

Cyclone heat treating, electric or fuel fired, box or pit.

Cyclone heat treating, electric or fuel fired, box or pit.

Homogenizing cyclone heat treating, electric or fuel fired, box.

RODS **BILLETS** **CASTINGS** **D. C. INGOTS**

60 cycle induction billet heater for extrusions.

For more information circle No. 46 on the Reader Service Card

LINDBERG heat for industry

FISHER EQUIPMENT WILL APPLY IT MOST EFFICIENTLY

NEW PRODUCTS AND DEVELOPMENTS

Want complete details on these announcements? Use the Reader Service Cards. You'll find them facing page 108 of this issue

STAINLESS STEEL POURING LADLES . . . in 23 sizes

Designed for the die casting industry, these stainless steel pouring ladles are 50% lighter than cast iron ladles. Developed by SPINCRAFT, INC., the ladles incorporate lightness, easy-pouring, and perfect balance desired by the operator, and the durability and cutdown on replacement costs desired by management. Shot-blasted for good coating adhesion, the ladles can also be used without coating for zinc, lead and kirksite. There is also the advantage of resistance to burn-out that only stainless steel can provide. The ladles come with full handle or with stub handle to fit standard pipe.

Circle No. 239 on Reader Service Card

30,000 LB. HOLDING FURNACE . . . has 3-section cover

This 30,000 lb. aluminum induction holding furnace, with a 3-section hydraulically operated cover, has been developed by the MELTING FURNACE DIV., LINDBERG ENGINEERING CO.

Shell of the furnace is mounted on heavy duty bearing trunnions and supported on structural steel legs. Chamber lining is of monolithic construction and is non-wettable to aluminum. The tilting mechanism features positive, safe, fingertip control. Pouring lip is located in the axis of tilting providing a constant pouring arc regardless of the furnace tilt. Ladles or molds do not have to be shifted during pouring.

The 3-section cover operates by means of two, 2″ bore – 25″ stroke hydraulic cylinders at 750 psi. One or more of the sections can be lifted simultaneously or the entire cover lifted and removed for cleaning. Power requirements: 350 KW – 480 Volts – Single phase – 60 cycles A.C. Dimensions: 17′-6″ long x 15′ wide x 10′ high. Weight: 75,000 lbs.

Circle No. 240 on Reader Service Card

1,000 TON DIE CASTING MACHINE . . . designed for 40 lb. castings

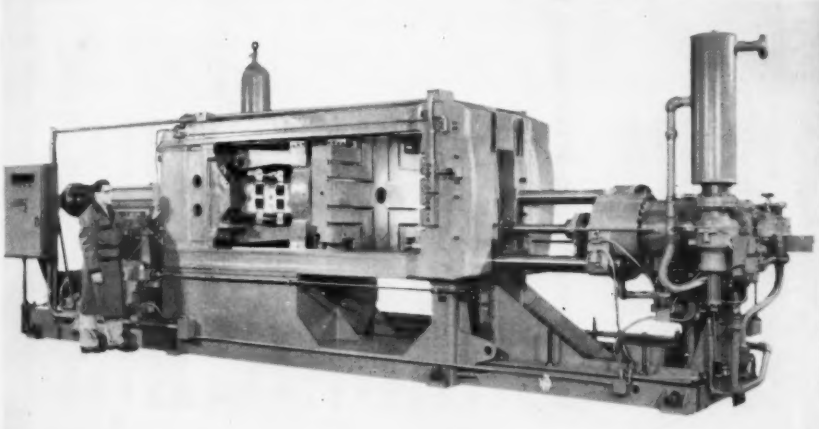
This die casting machine was especially designed by LESTER-PHOENIX, INC. for casting such parts as gas meter housings, motor blocks for outboard motors, and street light housings. The machine, Model HP-3½X-40C-SF, incorporates the Lester Pre-Fill Injection System. This provides high initial speed with high final impact, to provide dense castings with excellent surface finish. The pre-fill system is used with a nitrogen accumulator with 11,000 cu. in. of capacity, (at 2,000 psi.), for highest initial shot speed. The stroke of the injection plunger is 25″.

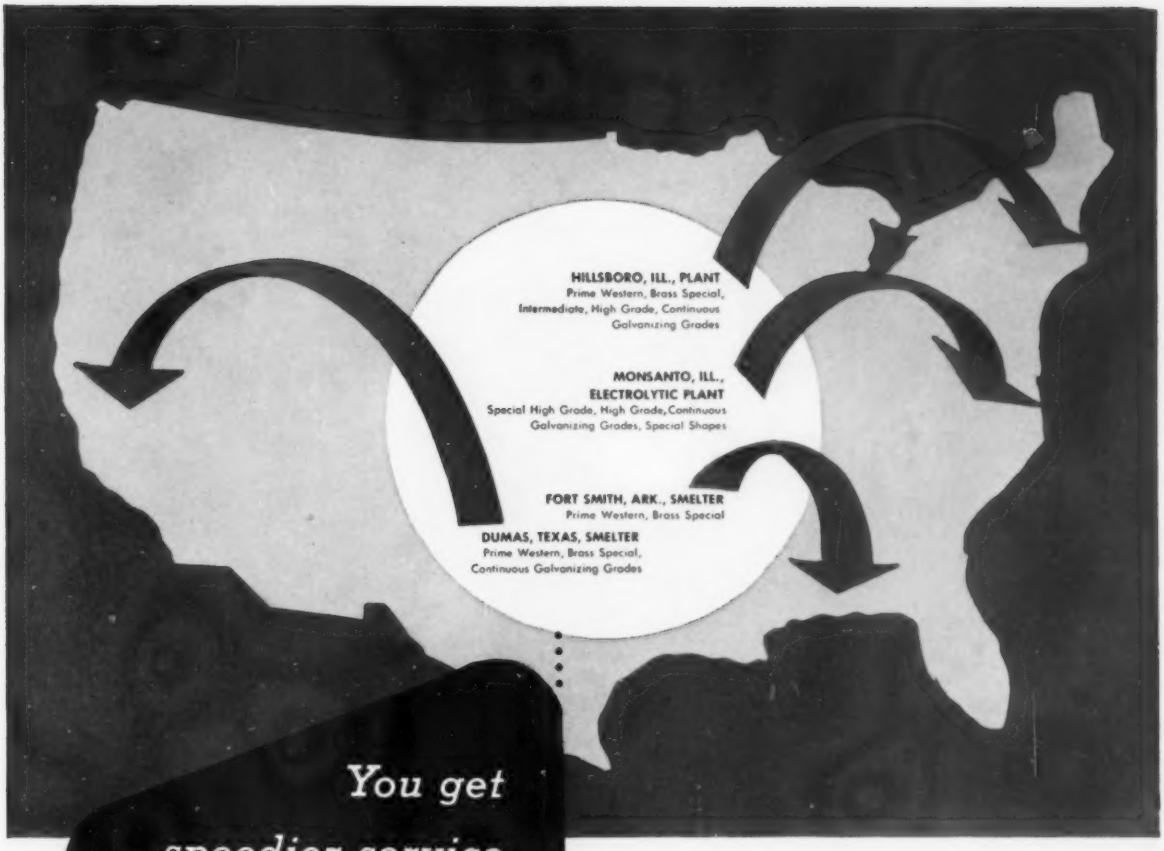
Maximum die height is 42″, adjustable to a minimum of 39″, with a total daylight of 72″. The die opening is adjustable from 30″ to 10¾″. The movable platen, is 60″ wide with a vertical clearance between the beams of 60″.

The locking mechanism is rigid single toggle and wedge. It gives 4-point lock with hardened cams and knuckles in the links to protect the toggle pins. The hydraulic system is such that it allows die slowdown or cushion to protect the die faces and die speed control.

Circle No. 241 on Reader Service Card

more new products on page 96




HILLSBORO, ILL., PLANT
Prime Western, Brass Special, Intermediate, High Grade, Continuous Galvanizing Grades
MONSANTO, ILL., ELECTROLYTIC PLANT
Special High Grade, High Grade, Continuous Galvanizing Grades, Special Shapes
FORT SMITH, ARK., SMELTER
Prime Western, Brass Special
DUMAS, TEXAS, SMELTER
Prime Western, Brass Special, Continuous Galvanizing Grades

You get speedier service from the ZINC ZONE

Central location of American Zinc plants assures prompt deliveries of slab zinc to any point in the nation.

PRODUCERS OF

ALL GRADES OF SLAB ZINC
ZINC ANODES (Plating & Galvanic)
METALLIC CADMIUM
SULPHURIC ACID
LEAD-FREE and LEADED ZINC OXIDES
ZINC CARBONATE
GERMANIUM DIOXIDE
AGRICULTURAL LIMESTONE
CRUSHED STONE

American Zinc sales Company

Distributors for AMERICAN ZINC, LEAD & SMELTING COMPANY

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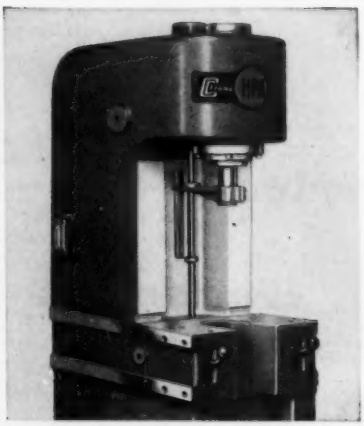
For more information circle No. 8 on the Reader Service Card

KIOWA CORPORATION, MARSHALLTOWN, IOWA, SAYS, "The advanced principles of the H-P-M die casting machines have solved many of our quality problems and our day-to-day die maintenance problems have been reduced."

Better quality . . . less scrap . . . consistently

H-P-M's solve die casting quality problems through advanced machine design principles



TOPS FOR TRIMMING: The new H-P-M manually controlled C-Press is tops for quick, clean hydraulic trimming of casting flash. Generous bed areas, dual safety controls, either lever or electrical, 5, 10, and 15 ton models, completely JIC for easy maintenance, **standard at no additional cost.** Send for new catalog just off the press.

Two major H-P-M die casting machine advancements offer unlimited opportunities for casting improvement:

(1) H-P-M's mechanical link-wedge clamping mechanism prestresses the machine's structural members for rigid clamping — lessens deflection when metal is injected under pressure.

(2) new injection speed control is infinitely adjustable for acceleration, high speed and pressure follow through.

With the first advantage, density factors and dimensional tolerances are held to exact requirements. Flash is reduced to the minimum and scrap loss is reduced to a negligible factor.

With the second, intricate detail can be faithfully reproduced time and time again with smooth surface finishes "the rule" rather than the exception. Pressure follow-through control packs metal for proper density.

These two difficult problems of the die casting industry have been top considerations with the H-P-M line of high speed die casting machines — available from 200 to 800 ton capacities. Get the facts on better casting control with H-P-M's, today.

HPM

THE HYDRAULIC PRESS MFG. COMPANY

A Division of Koehring Co. • Mount Gilead, Ohio, U. S. A. H933

For more information circle No. 39 on the Reader Service Card

Does your new design call for a special alloy?

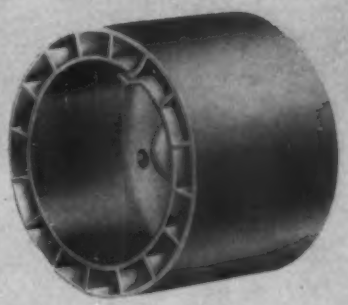
...ask Arwood about investment casting

When you design your new part for investment casting, you neatly sidestep that age-old designer's dilemma: part performance versus ease of production.

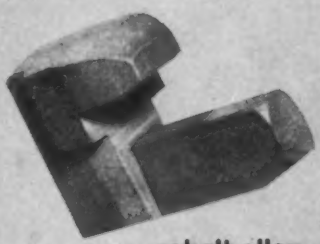
If the best alloy for the application is a machinist's nightmare, specify it and let Arwood worry about it. It won't bother us; our four foundries cast everything from magnesium and aluminum to cobalt-base and nickel-base alloys and stainless steel.

Arwood's complete service from blueprint to finished investment casting frees your hands to design for function and end use. Arwood will give you the shape you need, the alloy you need, and the quantities you need, from a few hundred to many thousands.

Write today for your free copy of the new 44-page Arwood "Practical Guide to Investment Casting". It provides all the information you need to evaluate the technique and use it to help solve your design problems.



magnesium



cobalt alloy

stainless steel

MACHINE THE SIMPLE...CAST THE COMPLEX

arwood

ARWOOD PRECISION CASTING CORP., 323 W. 44th St., N. Y. 36, N. Y.

A complete service from design through tooling, production and finish machining.
Sixty-two engineering consultants from coast to coast.

PLANTS IN BROOKLYN, N. Y.; TILTON, N. H.; GROTON, CONN. & LOS ANGELES, CALIF.

For more information circle No. 10 on the Reader Service Card

Relay Frame made by Madison-Kipp for Westinghouse Air Brake Company, Union Switch and Signal Division.

ADDED DESIGN POWER with MADISON-KIPP zinc and aluminum die castings

Your design problems require your own special talents. Die casting is a unique art in which Madison-Kipp mechanics are seasoned and skilled. By combining these talents the resulting design power is raised to a high degree.

The difficult die casting with 2 steel inserts here illustrated was developed and produced with the close cooperation of the user and the die designer.

Please clip this ad as a reminder to contact us when you have die casting requirements.

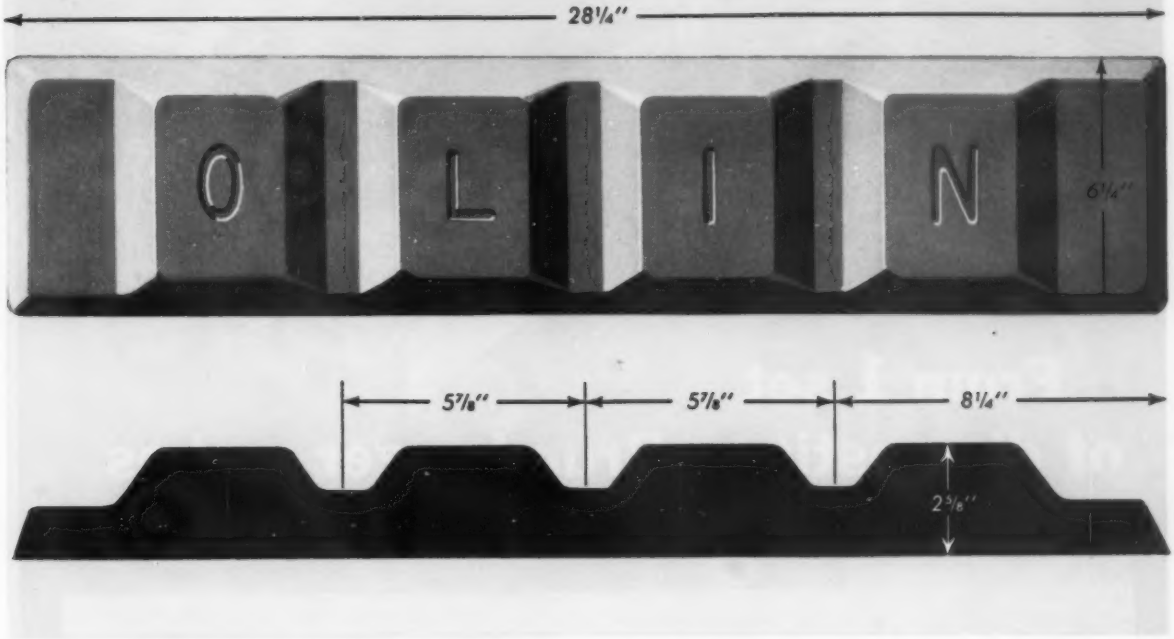
kipp

MADISON-KIPP CORPORATION
213 WAUBESA STREET • MADISON 10, WIS., U.S.A.

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

For more information circle No. 49 on the Reader Service Card

YOU'LL FIND GOLD
IN THIS NEW 25 POUND OLIN ALUMINUM INGOT!



Now, a 25 pound ingot from Olin Aluminum. Consider its advantages for you!

Smaller size. Easier to store, easier to gauge metal supply for closer control.

Lighter weight. 25 lbs. vs. 30 lbs. Greatly increases handling efficiency.

Deeper notches. Easier to break. Saves time, eases work load.

More sections. 3 notches, 4 sections vs. 2 notches, 3 sections. Reduces waste.

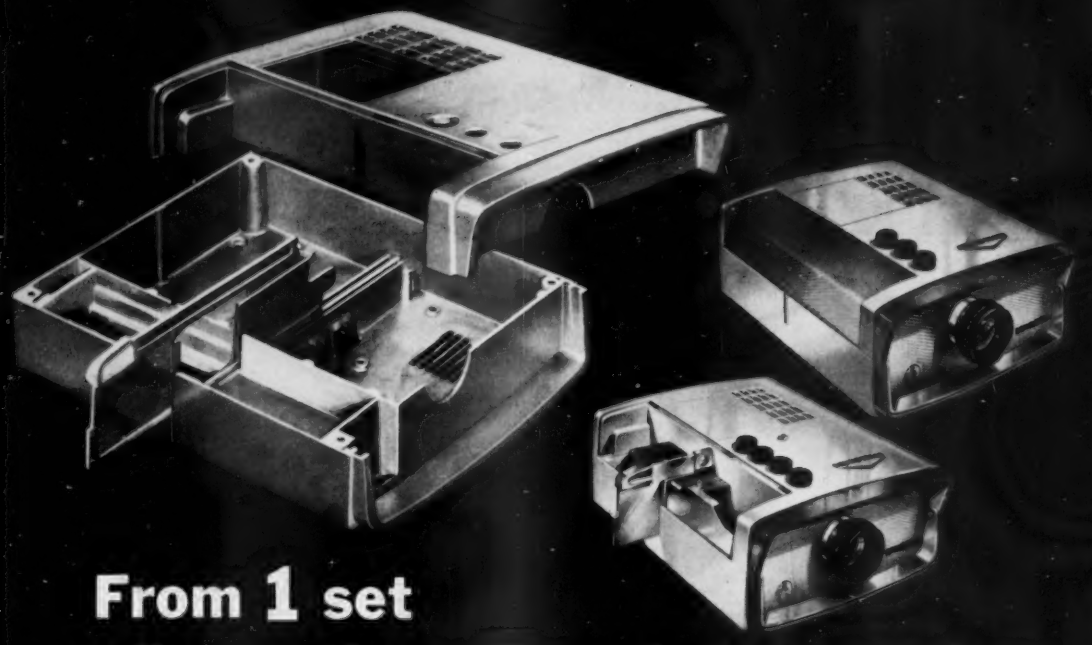
Same price per pound as 30 lb. ingot. Olin Aluminum is the only prime supplier producing a 25 pound ingot, and at no additional cost.

America's new major aluminum producer, Olin Aluminum, is also the newest source of profitable ideas for foundrymen. Take advantage of it. Contact your nearby Olin Aluminum Sales Office or Authorized Distributor of casting alloys. Ask for our pig and ingot technical data bulletin. Metals Division—Olin Mathieson Chemical Corporation, 400 Park Avenue, New York 22, New York.

OLIN ALUMINUM

Symbol of New Standards of Quality and Service in the Aluminum Industry

For more information circle No. 59 on the Reader Service Card



From 1 set of die castings Brumberger makes 2 different products

CASE HISTORIES FROM MT. VERNON FILES

If you like to project color transparencies, these two new automatic Brumberger* 35 mm, low silhouette, slide projectors will dazzle you. They are priced much lower than other automatic projectors and eliminate the additional expense of slide magazines and extra carrying case.

These are fine examples of keen engineering perception, for all the inherent advantages of die casting have been applied with those of metal stampings and plastics to produce competitively priced photographic products of outstanding eye appeal and performance.

As you can see, these aluminum die castings are intricate. All the necessary slots, channels, pins, gratings, bosses, holes, compartments, handle holes and various recesses are incorporated into the shells so that simple, rapid assembly and minimum finishing operations of the final product result.

Heat from the projection lamp will not warp or weaken the castings, and correct alignment of the optical system is maintained at all times by the thin but rigid, lightweight sections. For Brumberger, die casting has proved to be a supremely advantageous manufacturing method.

More than that, Brumberger has made full use of Mt. Vernons' complete four-fold service: coordinated designing, die making, casting and machining facilities all under one roof in 200,000 square feet of manufacturing space.

And when you plan to make a better product at lower cost by resorting to die castings, we can also give you invaluable help. Just call in your nearest Mt. Vernon sales representative for fast service.

*Brumberger — Brooklyn, N. Y.

MT. VERNON
DIE CASTING CORP.
STAMFORD, CONNECTICUT

DIE CASTING RESEARCH FOUNDATION PARTICIPANT

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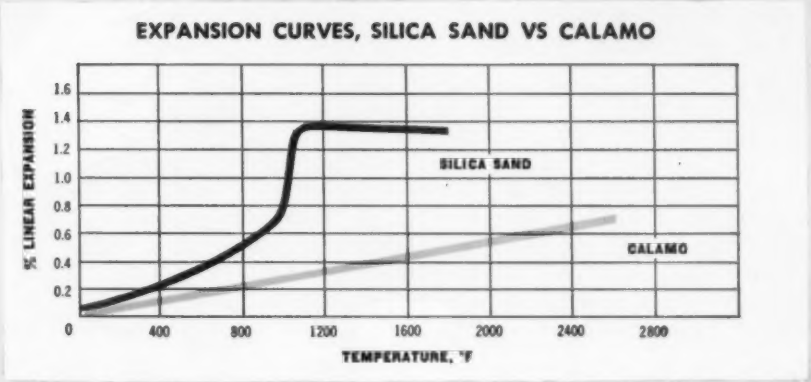
For more information circle No. 53 on the Reader Service Card

Harbison-Walker

REFRACTORY MOLD MATERIALS

for metal casting



Calamo for Investment Molds

CALAMO, one of the extensively used Harbison-Walker products for molding is an alumina-silica refractory of optimum sizings for various molding mixtures. Its fusion point is 100°F. higher than that of normal silica sand mixes.

The chart above shows the exceedingly desirable expansion curve of CALAMO as compared with that of silica sand.

CALAMO, used as the major constituent of precision casting investment mixes, improves the dimensional constancy of the molds, makes them stronger and more resistant to erosion by metal flow. Investment costs are measurably reduced because an appreciably lesser amount of bonding agent is needed. This is attributable to the very desirable particle sizing and the equiaxed, dense grains of CALAMO.

CALAMO, used alone or as the major part of conventional dry sand molding mixes in rammed or in slinger-placed sand molds, provides not only the very desirable low thermal expansion characteristics particularly suited for precision casting but also provides the required refractoriness for melts and alloys melted at unusually high temperatures.

H-W Flintgrain for Ceramic Shell Molds

H-W Flintgrain is an alumina-silica refractory, similar in composition to CALAMO, having the same very desirable low thermal expansion characteristics, but greater angularity of grain shape.

The angular grain shape and optimum size distribution make H-W Flintgrain ideal for securing maximum compactness in the mold. It is used with special benefit for making ceramic shell molds and for similar applications in which dense, compact mold sections of greatest volume stability at all temperatures, are of paramount importance.

Illustration of angulate shape of H-W Flintgrain (x 3)

Write us for information regarding these and other Harbison-Walker products —mold wash materials—ceramic molding media—mold sand bonding clays.

HARBISON-WALKER REFRACTORIES COMPANY

AND SUBSIDIARIES GENERAL OFFICES: PITTSBURGH 22, PENNSYLVANIA

World's Most Complete Refractories Service

For more information circle No. 35 on the Reader Service Card

LARGE DIE-CASTINGS . . . .

OR

SMALL DIE-CASTINGS . . . . .

DOLLIN Specialized Equipment gets the most out of each!

Dollin's extensive facilities include the most modern, high-speed die-casting machines of every type and size, to produce parts from the largest commercial sizes down to fractions of an inch. Much of the equipment is designed by Dollin engineers and provides advantages found in no other machines.

This advanced equipment, coupled with Dollin engineering, die-making, foundry and machining facilities, offers you the ideal source of high-volume, high-quality die-castings, at the lowest possible cost.

LARGE CASTINGS

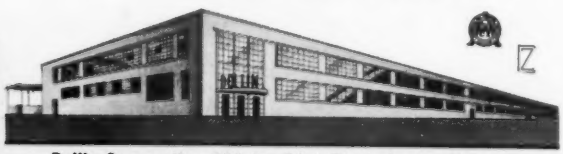
Aluminum castings made on large cold chamber type high-pressure machines. Large zinc castings made on large plunger type machines.

SMALL ZINC CASTINGS

1000 per lb. to 3 per lb., made on fully-automatic, high-speed machines. More design latitude—high accuracy—lower tool and piece costs.

Submit prints or samples of any parts for engineering advice or quotation.

DOLLIN Zinc and Aluminum DIE-CASTINGS



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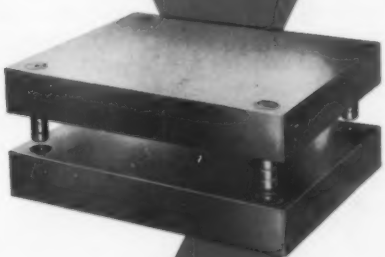
DIE CASTERS!

SAVE MONEY ON YOUR DIE CASTING DIES

D-M-E Standards can save you time and money on every die with less initial cost and longer die life.



D-M-E STANDARD CAVITY RETAINER SETS
Available in Carbon or Alloy Steel

Wide Range of Standard Sizes
from 9⅞" x 8" to 23¾" x 35½".
Standard plate thickness from ⅞" to 5⅞".
Ground flat and square — ready for cavity inserts.

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- D-M-E CORP., CLEVELAND: 502 Brookpark Rd.—DAYTON: 558 Leo St.
- D-M-E of CANADA, Inc., TORONTO, ONT.: 156 Norseman Ave.

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NEWS OF INDUSTRY & ASSOCIATIONS

activities of people, companies & groups in the precision metal molding industries

INVESTMENT CASTERS HOLD DESIGN CLINIC

A workshop session where design engineers got expert answers to questions about investment castings was held in Santa Monica, Calif., in March by castings producers.

As the first Investment Casting Design Clinic, it was the prototype of similar events planned for eastern and midwestern industrial centers. The Clinic, lasting an entire day, was co-sponsored by the national INVESTMENT CASTING INSTITUTE and the western region INVESTMENT CASTERS SOCIETY.

Attendance was purposely limited. Without advance publicity, and with only a restricted number of invitations handed out, attendance was held to slightly more than 100, to keep workshop sessions small enough for easy interchange of information.

Simultaneous talks on design, applications, alloys and specification were held, being repeated four times during the day so that each visitor could sit in on each discussion. Most guests of the investment casters came equipped with pointed questions based on current materials and design problems.

Focal point for the day's activities was a roomfull of examples of the investment caster's art. In a display garnered from the sample racks and display shelves of dozens of investment casters, prime examples of these castings in all alloys and for all types of industries were put on show.

Design Clinic chairmen were Richard Gray for ICI and George Wilson for ICS, with much of the liaison and arrangements coordinated by Lawrence Schwedes, a member of both organizations.

Timing of the Design Clinic was keyed to the Spring meeting of the Investment Casting Institute, being held on the West Coast for the first time.

more industry news on page 77

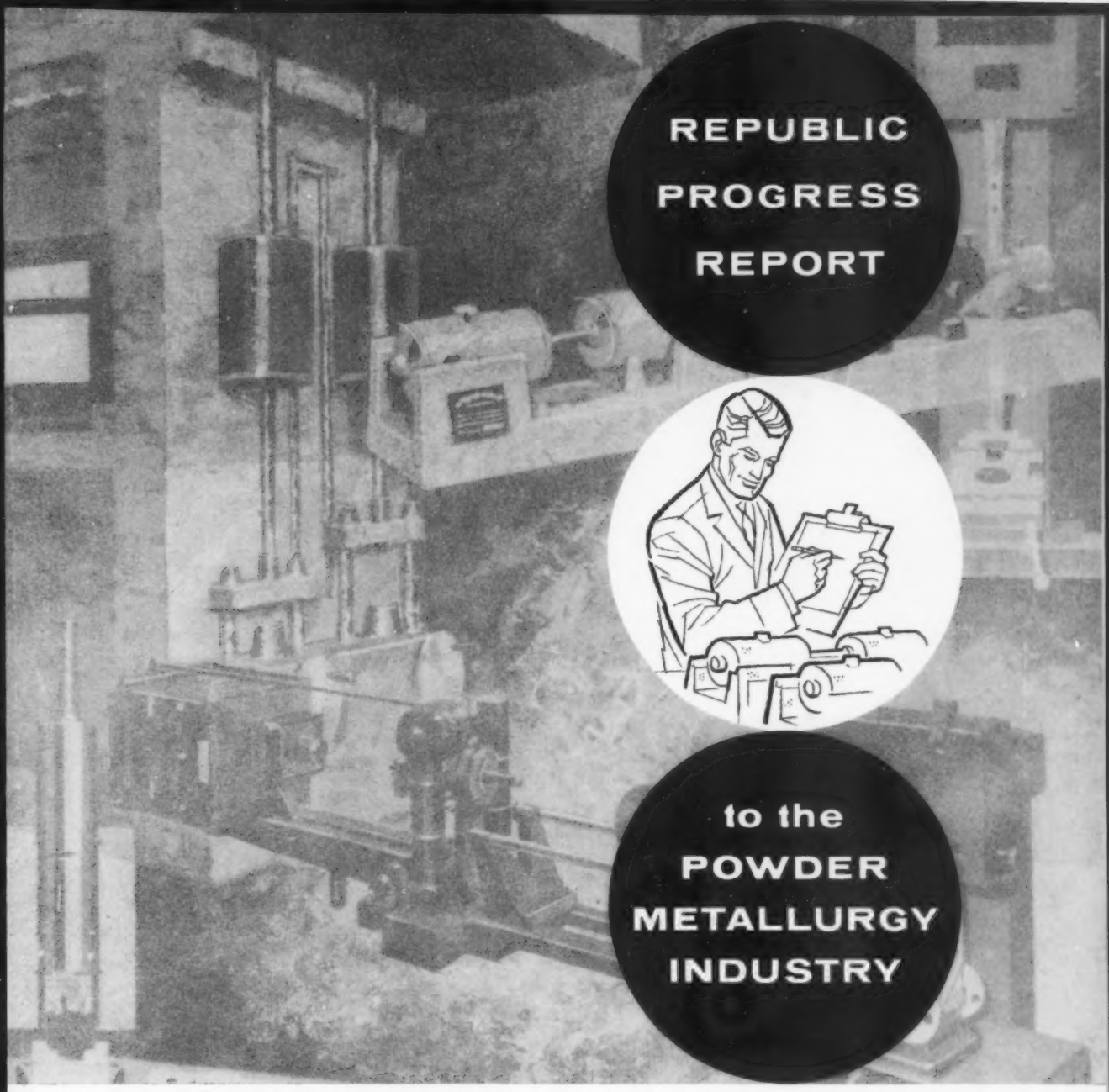
COMMITTEE MEMBERS (left to right): Harry Dolan, ICI executive director; Lawrence R. Schwedes, ICI director and president of Investment Casters Society; R. R. Miller, ICI president; Dick Gray, ICI director. Not shown: John Morrison, vice president; Ted Operhall, director.

ALLOYS section was run by F. K. Iverson (left), general manager of Cannon-Muskegon Corp., and Roger Metzler, general manager, Wai Met Alloys Co.

SPECIFICATIONS section was conducted by Lawrence R. Schwedes, president of Lawrence Laboratory and ICS president.

APPLICATIONS discussion at Design Clinic were guided by W. A. Dubovick, pres., Engineered Precision Casting Co.

DESIGN section sessions at the clinic were conducted by George Wilson, president of Humphrey Castings, Inc.



ON FATIGUE TESTING...

Preliminary Fatigue Test Data on Type HS6460 High Strength Powder

SET 1—COMBINED CARBON 0.20% (Initial Tensile—60,000 psi)

CYCLES	STRESS (psi)
100,000	28,500
1,000,000	24,200
10,000,000	22,000

SET 2—NO CARBON ADDED (Initial Tensile—35,000 psi)

100,000	19,000
1,000,000	17,000
10,000,000	15,500

Procedure Used to Obtain Test Results

Material—Type HS6460 with 1% zinc stearate. Single press and sintered blank machined to standard A.S.T.M. Fatigue Bar—.300″ dia. Testing machine—R.R. Moore Rotating Beam.

Sintering conditions for Set 1—Endothermic atmosphere, dew point +30°F, 2050°F, 45 minutes at heat (extended time because of size). Briquetting pressure —100,000 psi. Density — 6.83.

Sintering conditions for Set 2—Hydrogen atmosphere, 2050°F, 45 minutes at heat. Briquetting pressure—80,000 psi. Density — 6.76.

For more information, write Republic Steel, Dept. PM-7712, 1441 Republic Building, Cleveland 1, Ohio.

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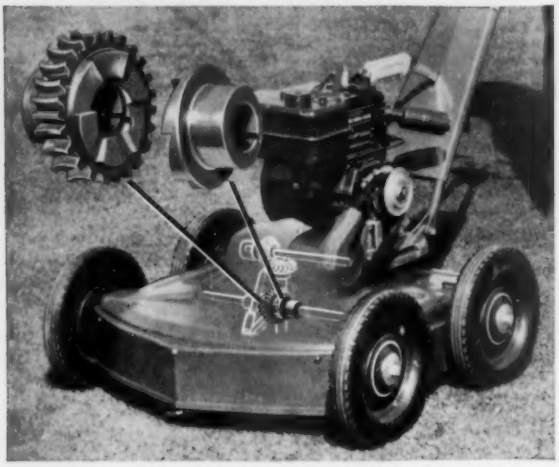
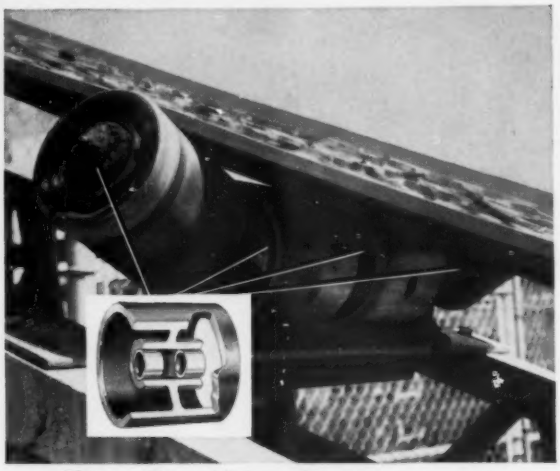
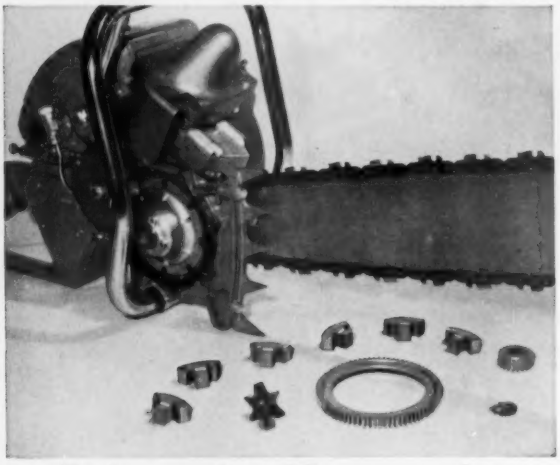
BOOST PRODUCT APPEAL with OILITE



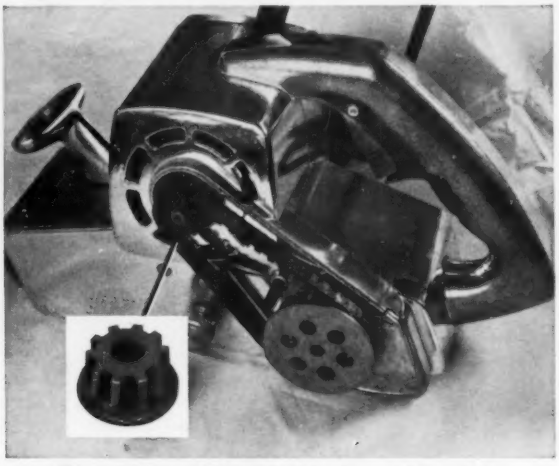
These 2 Oilite components now do the work of 4 former machined parts . . . contribute new economy, less upkeep.



Not one "squeak" from this conveyor . . . yet the dirt-encrusted Oilite bearings haven't been lubricated in 7 years.



Tough, wear-resistant Oilite gears, sprockets and clutch shoes keep costs low . . . make power saw more dependable.



The Oilite pulley of this heavy-duty belt sander provides yet another example of improved performance at less cost.

Quality-built OILITE®* parts and bearings add sales appeal to many fine products. For one thing, close tolerance Oilite parts wear less, weigh less and are quieter running . . . and Oilite bearings are tougher, maintenance-free.

** Only Chrysler Makes Oilite*

For another, Oilite components drastically reduce cost by eliminating material waste and costly machining. Why not contact your Oilite representative today? Look for him in the Yellow Pages under "bearings — Oilite" or write Dept. L-5.

PM PM MEMBER

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A CHRYSLER OILITE PRODUCT

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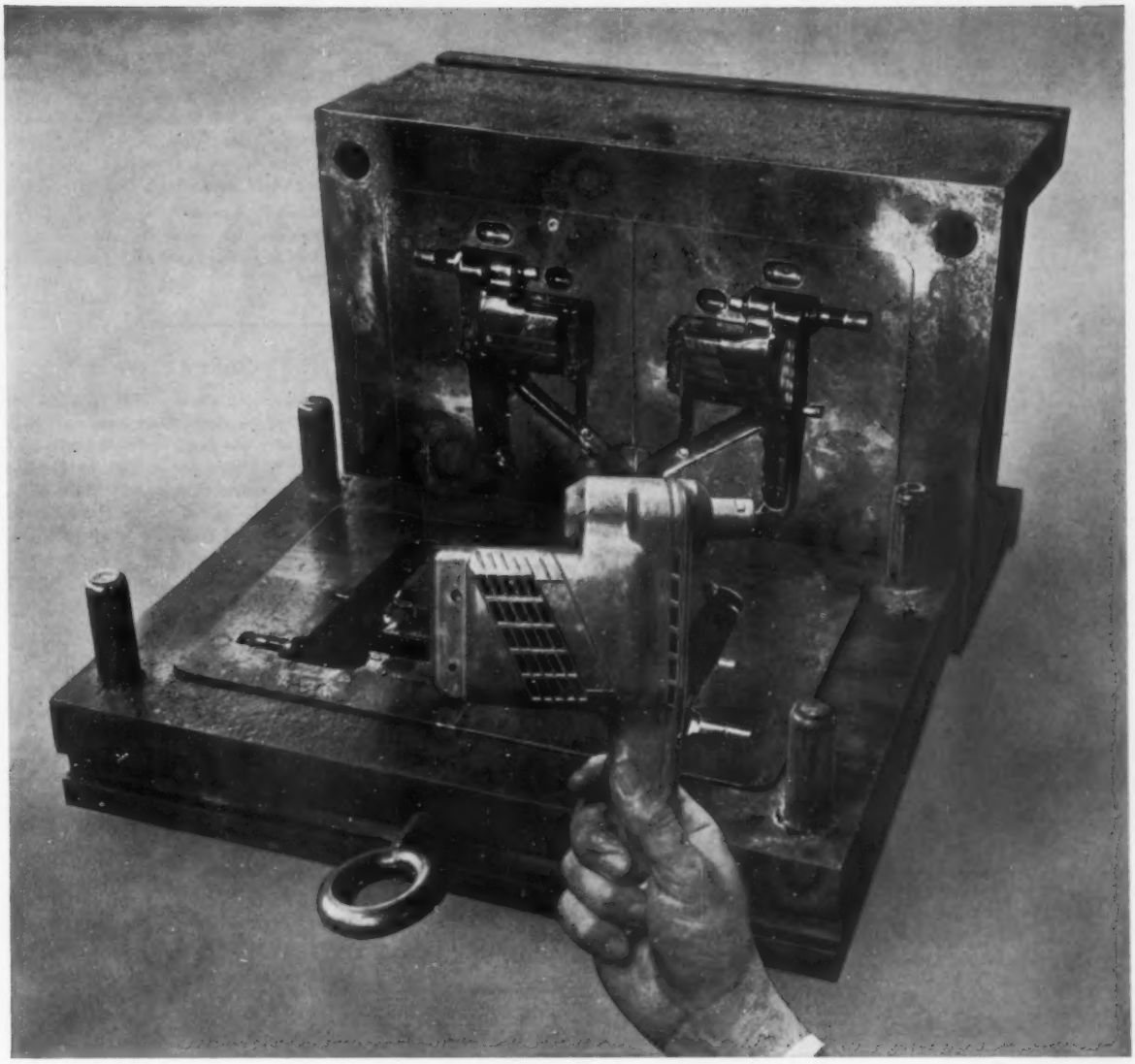

Team up with Cromo-High V for economical die casting

Nearly any die-casting job can be handled economically with Cromo-High V —Bethlehem's 5 pct chrome-moly tool steel with 1 pct vanadium.

Cromo-High V is engineered for die casting work. It's extra tough, and is resistant to wash and erosion. Made by a controlled melting procedure, it has good center density and grain refinement. It's also uniformly annealed for easy machining, and is free from porosity.

Cromo-High V is ultrasonic-tested to make sure that every bar has the same high quality. You can count on it to respond uniformly to heat-treatment. Even in massive sections it hardens up to Rockwell C 45-47.

Your Bethlehem tool steel distributor carries a complete range of Cromo-High V in stock, and is at your service. Give him a call today.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
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BETHLEHEM STEEL

BETHLEHEM STEEL

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PMM OPPORTUNITIES
jobs & equipment

Opportunities rates: $20 for the first column-inch; $15 for each additional column-inch payable in advance. To answer box number advertisements, address responses to the box at Precision Metal Molding. 812 Huron Rd., Cleveland 15, Ohio. Closing date: 1st day of month preceding publication.

EQUIPMENT

For Sale: 1 Pangborn Hydro Finish Serial #1EZ-5223 complete with Motors, Pumps and Blowers, Regulators, Valves, etc. Contact: International Powder Metallurgy Co., 439 W. Main Street, Ridgway, Penna.

POSITIONS OPEN

Chemist, Chem-Engr., Metallurgist

For research, development and process control in investment castings. Must have at least 5 years experience in the investment casting field with emphasis on research and development problems. Prefer well rounded background, including supervisory ability, experience in wax, investments (ferrous and non-ferrous) precoating, investing and foundry procedures. A knowledge of shell techniques would be desirable but not required.

Send complete resume. Salary commensurate with experience and ability. All replies will be held in strictest confidence. Use Box No. 5159.

FOUNDRY EXECUTIVE

We are seeking a manager 35 to 50 for our established, small, Midwest investment casting foundry who has a technical background and varied experience in both ferrous and non-ferrous investment casting. He must be capable of taking full charge of production, engineering and sales as well as participating in general management of the company.

Vice-Presidency is open to the qualified man. Commensurate salary plus profit participation.

Please submit a complete confidence resume of your previous employment, educational and personal background, past earnings and salary requirements. Box No. 5259.

EXPERIENCED DIE CAST ENGINEERS

Nationally known manufacturer of consumer appliances is rapidly expanding its well established jobbing die cast division.
We are paying industries' top salaries for the following positions.

- Sales Engineers & Reps.
- Estimators
- Die Designers
- Methods Engineers
- Industrial Engineers
- Product Designers (mechanical)

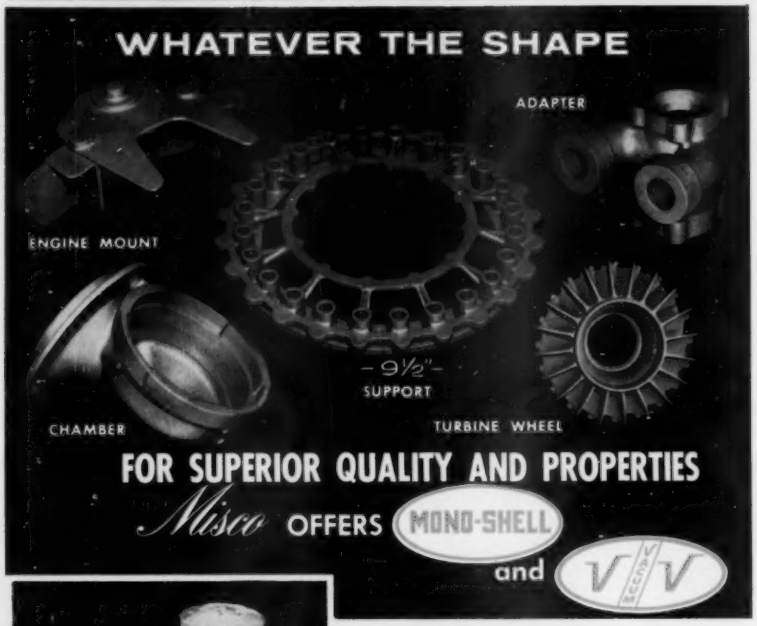
We have a completely modern plant specializing in Aluminum work in the 400 to 800 ton equipment range. Chicago location.

If you have 3-10 years experience in a die cast shop, don't miss this chance to get ahead — FAST.

Reply stating FULLY your experience, work history, age and present salary. All replies will be promptly answered. Box No. 5359.

SALES REPRESENTATIVES

Leading eastern investment casting company making both ferrous and non-ferrous castings has open territories in eastern Pennsylvania, New Jersey, Massachusetts, Indiana and Texas. Desire representatives handling castings and forgings only. Give full particulars. Box No. 5459.



Valve casting and its MONO-SHELL

Misco's MONO-SHELL process permits manufacture of many new components once avoided by conventional investment casting systems. Castings by MONO-SHELL weighing 25 lbs., 12" dia. x 6" high, poured in air or vacuum by the DOUBLE-V system are commonplace today.

Surface qualities in the as-cast condition average 70-90 R.M.S.

MONO-SHELL permits wide selection of stainless steels and high temperature alloys with improved metallurgical qualities and properties.

Stainless Steels		Hi Temp Alloys		Vacuum Alloys	
310	304	AMS 5382	AM 355	A-286	Udimet 700
410	316	AMS 5385	WI-52	713	GMR 235
347	17-4 PH	AMS 5388	Vascojet 1000	Waspaloy	Rene'41
431				Udimet 500	

Write us for specific data on alloys produced by MONO-SHELL; or better still, submit your drawings to our Engineering Staff for a value analysis.

Misco Precision Casting Company

Plants in WHITEHALL, MICHIGAN MUSKEGON, MICHIGAN

MISCO

Sales Offices in Principal Cities

Address inquiries to 122 Gibbs St. WHITEHALL, MICHIGAN Whitehall 2-1515

PRODUCERS OF AIRCRAFT AND INDUSTRIAL INVESTMENT CASTINGS

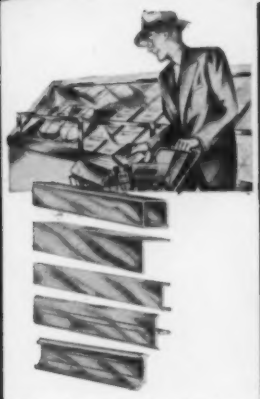
For more information circle No. 51 on the Reader Service Card

GENERAL EXTRUSIONS *Versatility*

IN DESIGNING AND PRODUCING EXTRUDED ALUMINUM PARTS IS YOUR GREATEST GUARANTEE OF SATISFACTION

Military tank part extruded and machined by G. E. I., to extremely critical tolerances.

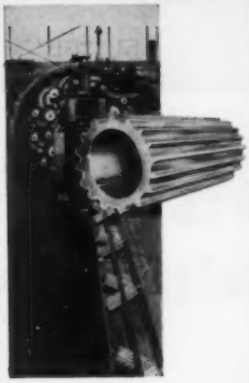
Metal office furniture parts produced with equal emphasis on perfect finish and functional efficiency.



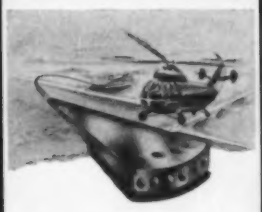
Price tag rails, glass framing, solid bar parts, edging, etc., produced for food store equipment manufacturers.

New development, DoRod, to prevent warping, expansion and contraction of wood doors, while doubling as weather-stripping.

G. E. I. extrudes antenna rods and other TV parts, performs additional fabricating.



This unprecedented conveyor roller solved a major production problem for an industrial rubber goods manufacturer.



This helicopter part is an outstanding example of pioneering in aluminum extrusions by G. E. I.

Main frame, glass insert frame, corner keys and handle designed and produced for bathtub enclosures.

Mill Representatives at St. Louis, Detroit, Pittsburgh, Cincinnati and Chattanooga.

Consult your classified phone book under Aluminum Products.

ALUMINUM GE INC. EXTRUSIONS "GENERAL LINE"

GENERAL EXTRUSIONS, INC.

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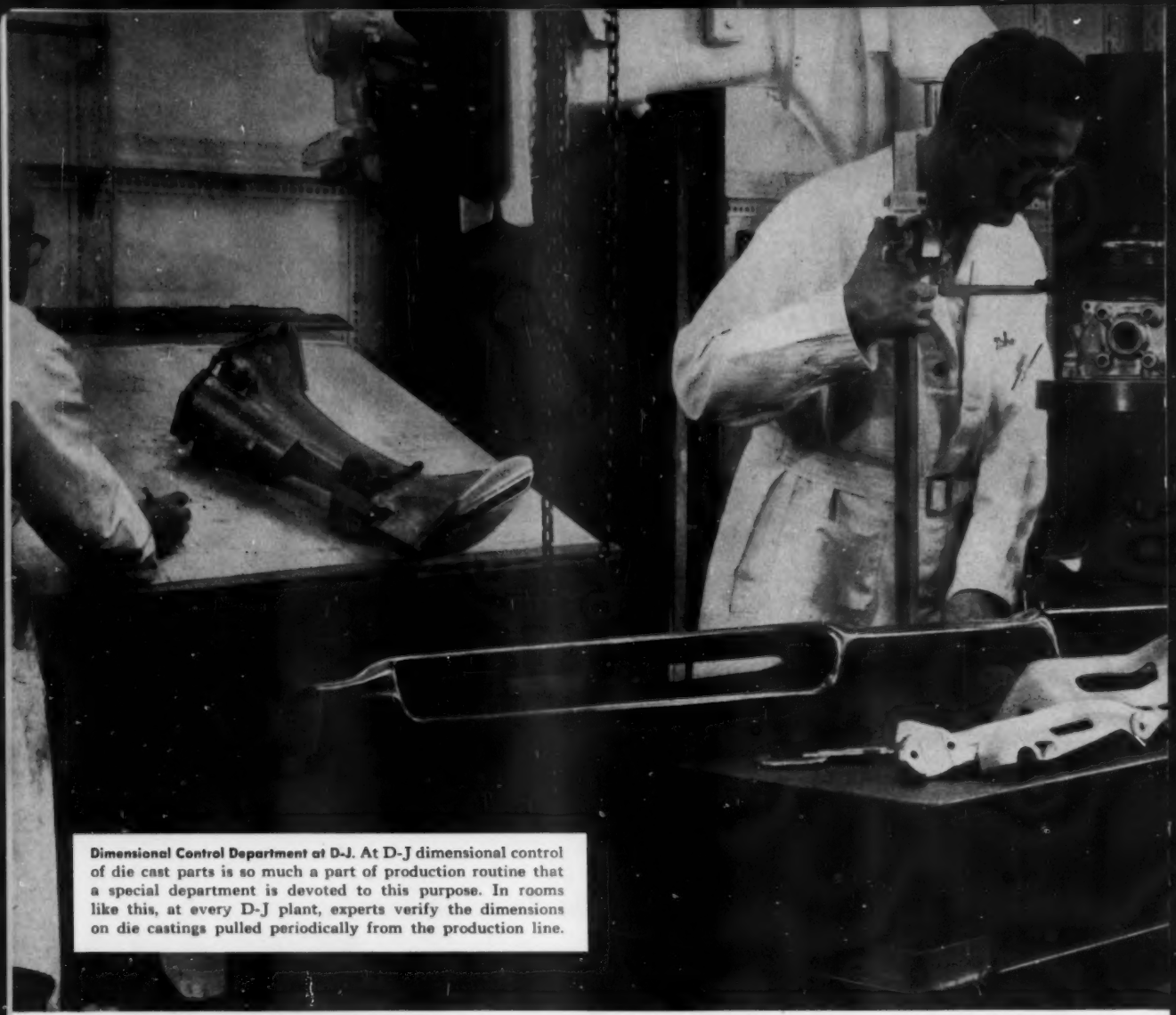


Dimensional Control Department at D-J. At D-J dimensional control of die cast parts is so much a part of production routine that a special department is devoted to this purpose. In rooms like this, at every D-J plant, experts verify the dimensions on die castings pulled periodically from the production line.

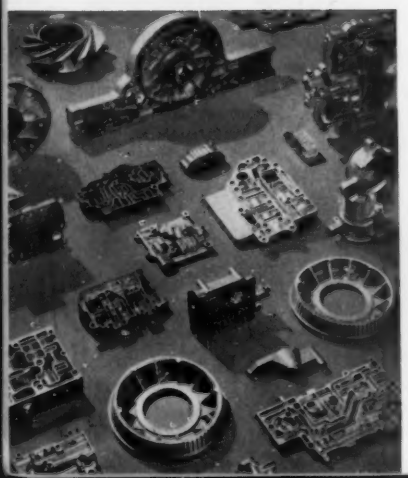
Outboard motor housing

Instrument panel bezel

Single cylinder engine block

Pinspotter part

At Doehler-Jarvis . . . everything improved production methods



Automatic transmission parts illustrate how much can be done with die cast design. Notice the ganged fluid passageways. Not apparent, but incorporated into the design of each of these parts, are many features that make these parts usable much as they are . . . with a minimum of further manufacturing needed.

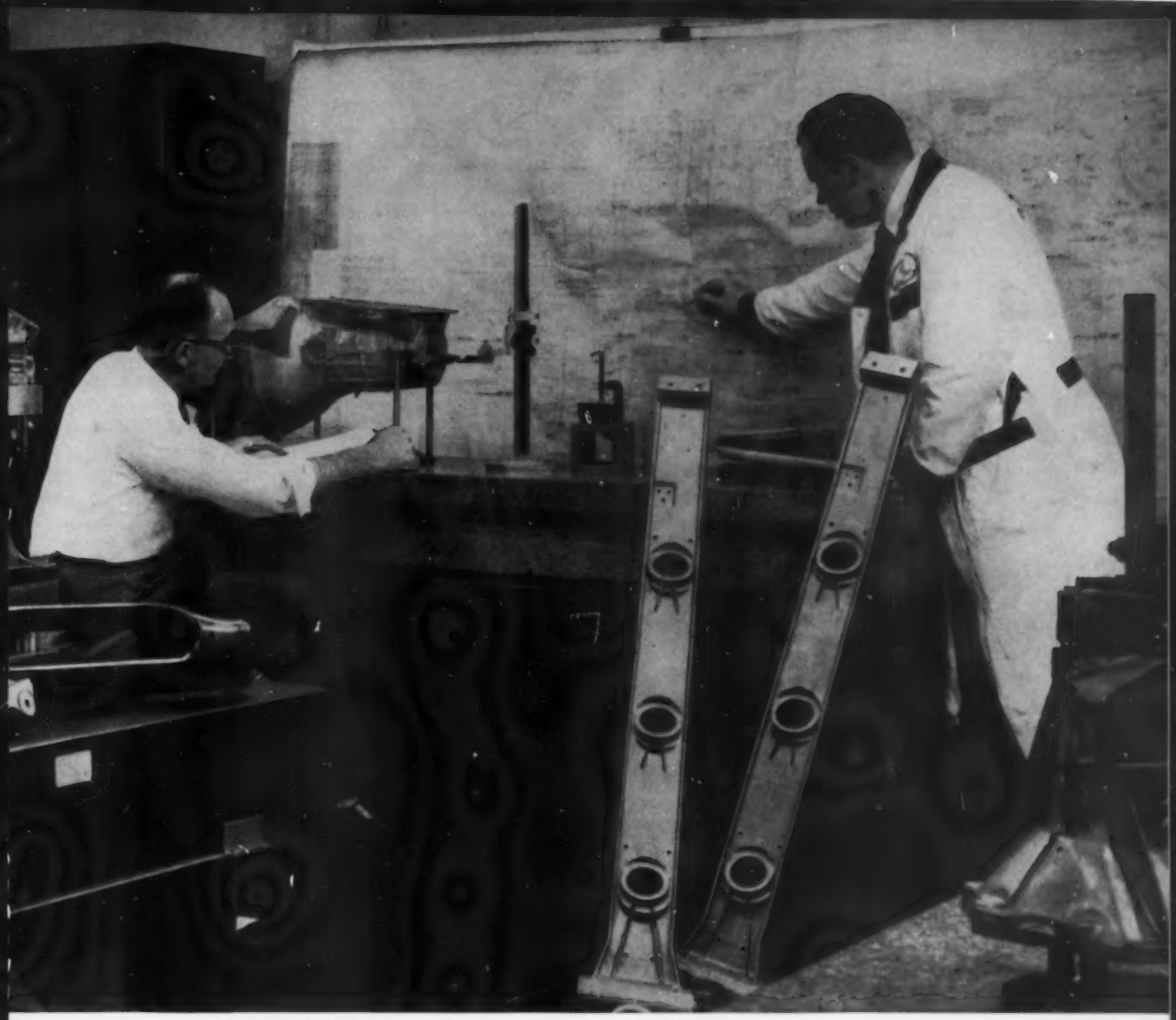
Only a handful of companies have ever taken *full* manufacturing advantage of the inherent opportunities presented by the purchase of die castings — opportunities to so design parts that production *all along the line* is simplified, speeded up, and made more economical.

Frequently die castings are bought under conditions where price is the dominant competitive factor. This approach sometimes makes good purchasing sense. And on the basis of price competition Doehler-Jarvis produces and sells more die castings per year than any other custom die caster.

But there is another, and often more rewarding, way to look at the purchase of die cast parts.

In many instances — most, in fact — a careful analysis of the part by experienced metal production men working in close coordination with equally experienced designers of the dies and the castings reveals ways to:

(1) reduce cost or improve performance of the casting itself.



Transmission housing | Pinspotter arms | Transmission part

needed to help you develop with the help of die castings

(2) introduce design features that eliminate one, many, or all of the machining, finishing or sub-assembling operations that must be accomplished before the part can be incorporated into the end product.

For example. Product engineers have only begun to realize the full range of applications made possible by the high fatigue strength inherent in aluminum die castings . . . by integrating several separate parts into one die casting . . . by ganging fluid passageways (as in automatic transmission designs).

Doehler-Jarvis customers who have taken this suggested broad viewpoint in purchasing their die castings find it pays off . . . sometimes enormously.

No producer of die castings can contribute more to this broad purchasing concept than Doehler-Jarvis.

In any category you care to name . . . research support . . . design help . . . skilled workmanship . . . versatility of metal working equipment (you can even buy *forgings, extrusions and stampings* from D-J) . . . sub-assembly facilities . . . choice of die casting metals and alloys . . . location of plants . . . delivery . . . Doehler-Jarvis provides more facilities than any other producer of die castings.

See what Doehler-Jarvis can do to help you realize the full potentials in die cast parts production. Call us in at an early stage in the design of your next new product or model change.

For more information circle No. 54 on the Reader Service Card

Doehler-Jarvis

Division of

NATIONAL LEAD COMPANY

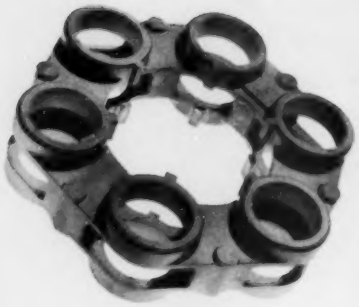
General Offices: Toledo 1, Ohio

In Canada:

Barber Die Casting Co., Limited

Hamilton, Ontario

Rx



an
INVESTMENT
CASTING
of course

because investment casting means easier, more consistent, more uniform parts with higher properties at lower cost.

made of
RxMet ALLOYS
of course

because RxMet alloys give better, more consistent results through precise metallurgical control.

smart designer
smart producer

because both specify investment casting alloys by:

WAI MET
ALLOYS CO.
1999 GUOIN STREET
DETROIT 7, MICHIGAN

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BETWEEN THE LINES

The editor's viewpoint on articles in current and forthcoming issues

DESIGNING PARTS to be made by die casting, extrusion, investment casting, permanent mold casting, powder metallurgy, plaster mold casting or shell mold casting takes some pretty special knowledge. A lot of design information is scattered through the literature. No engineer can be expected to have all of this varied information at his finger tips, nor know where to get it in a hurry. That's why we have tried to gather as much of it as possible into the April and May issues. These design packages are not the complete answer to the designer, but should be helpful in working out many of the basic problems.

So many companies and individuals have contributed to these two design sections that individual acknowledgements are not possible. To all those companies and people, our thanks.

IN THE APRIL issue much of the material was on the physical and mechanical properties of the metals and alloys which can be used in the various processes. In connection with this data there was a serious error. Under the zinc die casting alloys we listed ASTM alloy B 86, alloy XXI. This alloy should be No. XXIII with the following composition changes and property changes.

COMPOSITION

Copper	0.10 max.
Aluminum	3.5 to 4.3
Magnesium	0.03 to 0.08

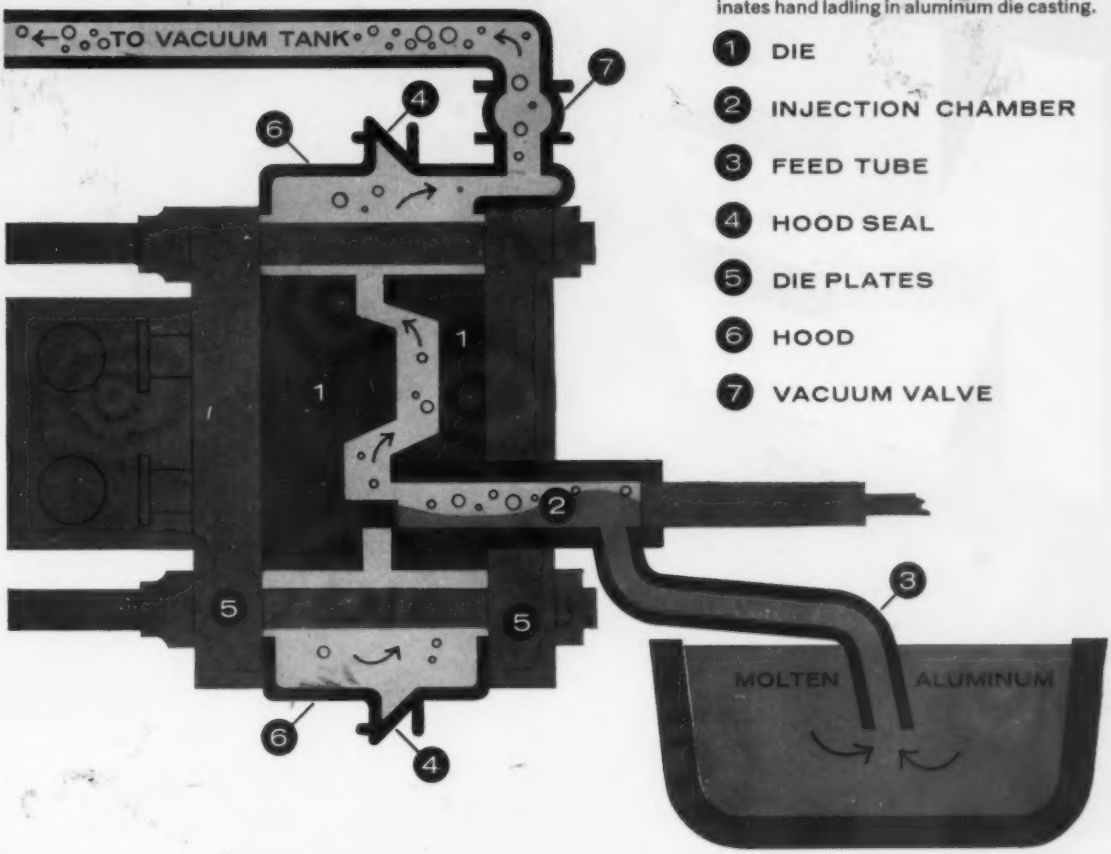
MECHANICAL PROPERTIES

Impact Strength	43
Tensile Strength	41,000 psi
Elongation in 2"	10%

PHYSICAL CONSTANTS

Brinell hardness	100
Compressive strength	93,000 psi
Electric conductivity	157,000
Melting point	386.6°C 727.9°F
Modulus of rupture	95,000 psi
Shearing strength	31,000 psi
Solidification temperature	380.0°C 717.1°F
Solidification shrinkage	0.14 in./ft.
Specific gravity	6.6
Specific heat cal./gm./°C	0.10
Thermal conductivity	0.27
Thermal expansion/deg. C	0.0000274
Thermal expansion/deg. F	0.0000152
Transverse deflection, in.	0.27
Weight, lb./cu. in.	0.24

We hope that the readers who are saving the April issue for these data will make the necessary corrections. Sorry the slip occurred.



Simplified cross-sectional diagram shows how Reed-Prentice Vacufeed process eliminates hand ladling in aluminum die casting.

REED-PRENTICE ALUMINUM VACUFEED SYSTEM

Combines Vacuum Die Casting and Automatic Ladling

Only the REED Vacufeed system eliminates hand ladling of aluminum and brings you all the benefits of vacuum die casting, too. Here's what Vacufeed does:

In Vacuum Die Casting

1 Instantly evacuates air from entire die and platen area
2 Produces denser castings with much finer detail
3 Eliminates telltale surface sink marks over heavy section bosses
4 Makes possible thin-walled castings which open up new markets to die castings
5 Permits casting of new alloys

In Automatic Ladling

1 Accurately meters and automatically feeds each shot of aluminum without any moving parts
2 Feeds metal faster than any other method of ladling
3 Draws molten metal from protected strata of furnace without interference from surface oxidation
4 Automatically ladles and casts silicone-free aluminum alloys which can be decoratively color anodized.

This new die casting combination—vacuum die casting and automatic ladling—adds up to an efficient profit making pair with tremendous potential. Ask your REED man for full details on the Vacufeed system and the Reed Vacucast process for zinc.

REED-PRENTICE

.....division of

PACKAGE MACHINERY COMPANY

EAST LONGMEADOW, MASSACHUSETTS

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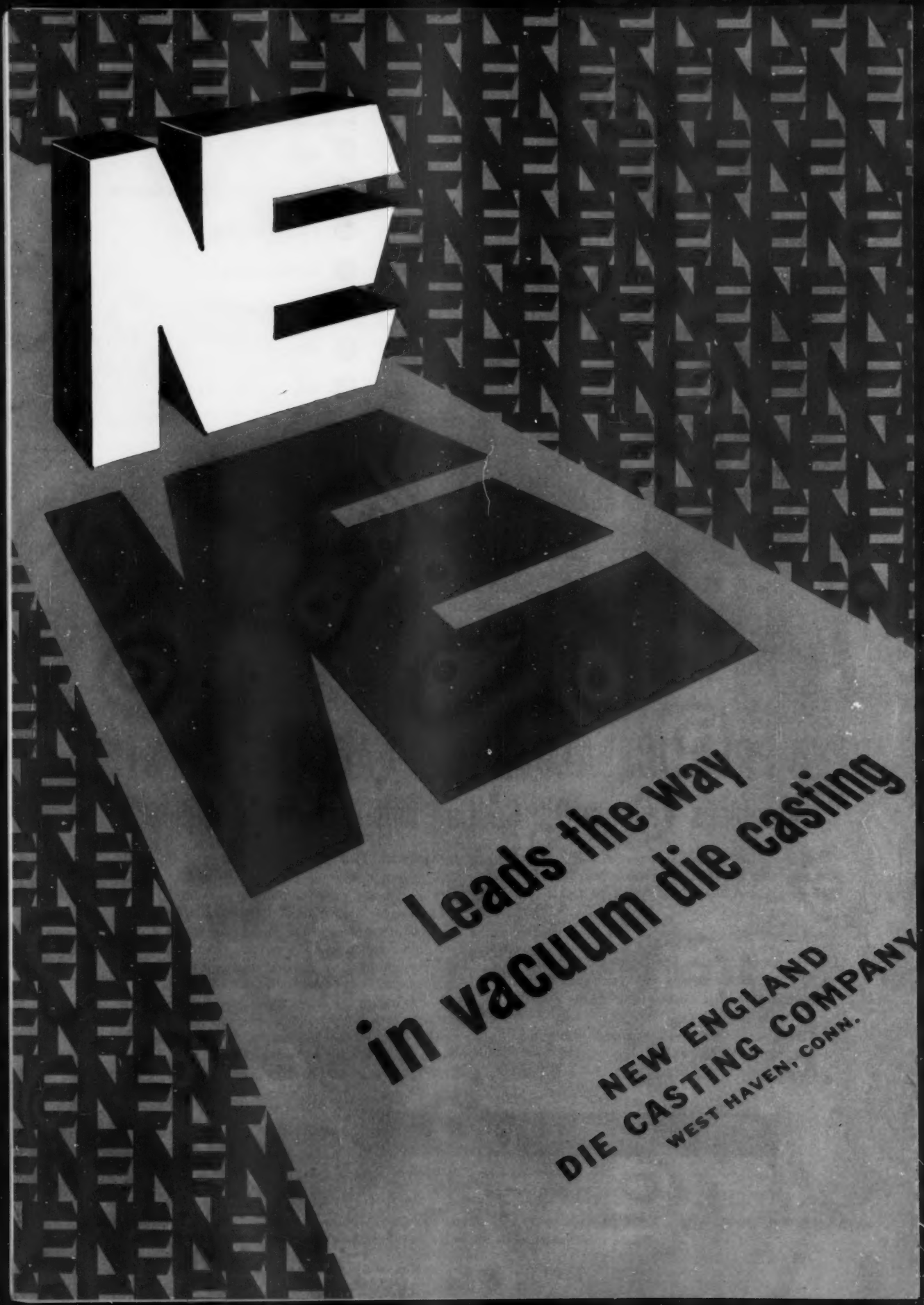
NE
Leads the way
in vacuum die casting
NEW ENGLAND
DIE CASTING COMPANY
WEST HAVEN, CONN.

Designing for Aluminum Die Casting

WHEN DESIGN calls for light weight, high strength and low production costs, aluminum die castings are usually the best answer.

ADVANTAGES OF DIE CASTING

Before examining the particular advantages and design features of aluminum die castings, let's review the general advantages of the die casting process.

1. Die cast parts are almost completely finished units and can be produced at high rates.
2. Dies, while initially expensive, have a long life.
3. Dimensional tolerances on the cast parts are more closely held than is possible in any other casting process. Reproduction from part to part is almost exact.
4. As-cast surfaces are usually better than with other high production casting methods.
5. Very small and odd shaped holes can be cored, but all holes must be straight to allow pulling rigid cores.
6. Thin sections, almost equaling stamped parts, can be cast, particularly with vacuum casting.
7. Scrap losses are low because runners, sprues, rejects, trimmings and machining scrap can be reused.
8. Due to lower machining and surface finishing costs, die cast parts, finished, are generally cheaper than parts made by other casting methods.
9. Inserts are readily cast in place. Both metal and non-metal inserts may be used.
10. Under some conditions, both internal and external threads can be cast.
11. Minimum size is smaller than for any other casting method. Maximum size is limited mostly by the size casting machines available.
12. A wide range of low cost alloys can be die cast. These include aluminum, brass, bronze, magnesium, lead, tin and zinc.

With these specific advantages of the die casting process in mind, let's examine some specific design practices and recommendations.

INSERTS

Inserts for greater strength, wear resistance, magnetic properties, ductility, hardness, integral fastenings, or irregular shaped passages are often cast in place. These are of materials different from that of the aluminum casting alloy in order to obtain special properties not provided in the alloy itself.

WALL THICKNESS

Walls should be as uniform as possible. When designing it is good practice to use thin walls and obtain the required strength by ribbing. There is, however, a practical minimum. Below this the die cavity will not fill properly. Design of the part, design of the die, the presence or absence of vacuum die casting all influence the minimum wall which can be cast. Generally, about 0.040" to 0.050" is the thinnest.

Taper required for ejection and the possible location of ejector pins will also influence wall thickness. The designer should have a good working knowledge of die design or be able to consult with a skilled die caster to design for the thinnest practical wall.

UNDERCUTS

Undercuts requiring loose pieces or collapsible cores should be avoided if possible. They increase tooling costs and slow down production. Such expediencies as the extension of the bosses to the parting line or changing them to the outside of the casting can minimize the use of undercuts.

DIE PARTING LOCATION

Whenever possible, parts should be designed so that the die parting is in a single plane rather than curved or irregular. Irregular parting lines increase the cost of both casting and trimming dies.

LETTERING

Design for raised lettering whenever possible. Die costs are materially lower if the lettering is inscribed into the die. Depressed letters on the casting may require engraved die inserts.

Lettering on a surface perpendicular to the parting line requires the use of loose pieces or moveable slides in the die to allow the casting to be removed. Always locate lettering so that it does not interfere with ejection of the part from the die.

REFERENCE POINTS

Always show reference points and planes on the blue prints so that the die can be constructed not to interfere with them. They also insure inspection from the same points by both the foundry and the customer.

DIMENSIONAL TOLERANCES

Always specify the most open tolerances possible.

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While die casting is capable of holding some specified dimensions to very close limits, tightening tolerances will always increase the cost of the casting. Consult your vendor before specifying close tolerances.

The cost of a die casting is the sum of the costs of the raw material, labor, initial tooling and overhead. In the tooling cost must be included the casting dies, trimming dies, and jigs and fixtures required to machine, polish, or plate the part. There are, however, some rules of design which will tend to keep costs down if they are followed.

Proper part design is also important as an aid in ridding the die cavity of air. While porosity due to entrapped air is seldom a problem, good part design will confine porosity to sections where it is relatively harmless. Regardless of the skill of the foundry, a part that is improperly designed can not be made economically.

GENERAL DESIGN RULES

There are a few general design rules which, if followed, will help to insure the best quality casting at the lowest cost. These are:

1. Keep shapes as simple as requirements permit; avoid projections except when necessary.

2. Keep weight as low and over-all dimensions as small as the attainment of other requirements will permit.

3. Sections should be thin, but sufficiently thick for ready casting. Ribs can aid in providing strength with minimum weight.

4. Uniformity in sections is desirable. If varied, transition should be gradual to avoid concentration of stress.

5. A slight crown is better than a large flat surface. This is especially true on highly finished parts where surface blemishes can mar appearance.

6. Avoid undercuts that increase die or operating costs.

7. Unless loose die pieces effect a net saving or other benefits, they should not be used.

8. Provide fillets at inside corners; avoid sharp outside corners.

9. Sufficient draft on cores and sidewalls must be allowed to insure removal of the casting from the die, without distortion.

10. If savings in metal and over-all cost will result, coring, or metal savers, should be specified where holes or recesses can be cored without undue die cost.

11. Design so that cores can be pulled easily and not require complicated die construction and operation.

12. Very small holes should not be cored unless unavoidable. The small cores are easily bent or broken, leading to high die maintenance costs.

13. Do not attempt to core holes in walls less than ⅛" thick unless there is a substantial saving over later drilling or piercing.

14. Keep core shapes as simple as functional requirements will permit.

15. Design with ejector pin location in mind. Ejectors will always mar the surface and if improperly placed can distort the casting by requiring too much force for ejection or by bearing on an improperly supported area.

16. If the casting is to be polished and buffed, design it with all finished surfaces easily accessible. Sharp corners and recesses increase finishing costs.

17. Design for minimum flash removal. Where flash will occur, it should be confined to unfinished surfaces to hold machining costs down.

18. Where machining must be done allow adequate metal for proper clean-up. Avoid excessive metal requiring deep cuts.

19. Cast threads when possible. Remember that internal threads require special core removal methods.

20. When ever possible, design for integral fastening devices. They reduce machining and assembly costs.

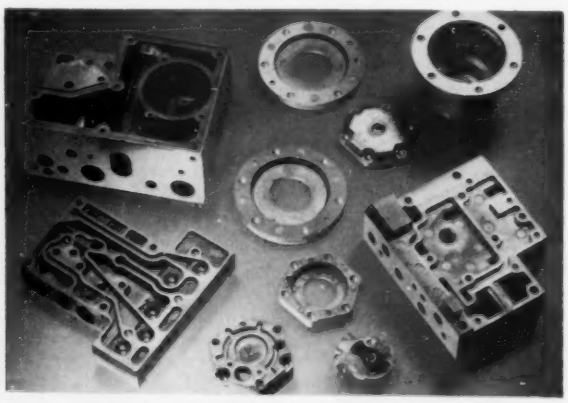
21. Inserts should be designed for easy placement and provided with adequate anchoring means.

22. If the die cast part will have an effect on final appearance, keep eye-appeal in mind. The casting should harmonize with the balance of the product.

23. KEEP TOLERANCES OPEN. BE REALISTIC AND LOWER THE COST OF THE CASTINGS.

24. CONSULT A COMPETENT DIE CASTER BEFORE A DESIGN IS FROZEN. HE CAN SUGGEST MINOR CHANGES WHICH WILL REDUCE TOOLING AND PART COSTS WITHOUT HARMING THE PART FUNCTIONS.

Material for this report from Kaiser Aluminum & Chemical Sales, Inc., Aluminum Industries, Inc., and Aluminum Company of America.



SHAPES LIKE THIS are among the many which can be designed for die casting in aluminum.

Designing For Zinc Die Castings

PRINCIPLES for designing die castings can never be fixed and unvarying in their application. General rules, if followed with judgment, can go far toward realizing a design that is both logical and helpful in attaining low cost. The suggestions given here are not universally applicable, and there are sound reasons for exceptions in particular cases. These rules furnish a check-list of general principles for the designer to use. Some of them may seem obvious, but even experienced designers sometimes overlook self-apparent points.

SECTION THICKNESS AND SIZE

In general, the smaller the size and thinner the section of the die casting, the lower the cost of both die and casting. Increased size and heavier walls always involve more metal, slower casting rate and possibly machining costs. A single large die casting may frequently be used at less cost in place of two or more smaller ones.

Maximum size of zinc alloy die castings depends upon the size of die and size of the die casting machine that it is economically expedient to use. Minimum size has no known limits. Zinc die castings weighing 1/20,000 oz. are in regular production.

Wall sections of zinc die castings should always be of minimum thickness consistent with ease of casting and with adequate strength and stiffness. This policy will not only tend to reduce the weight of metal required, but its application also helps to accelerate cooling in the die and thus increase production rates. Furthermore, thin sections are stronger *in proportion to thickness* than thicker ones. Ribs will provide additional strength where necessary and aid the flow of metal into thin sections.

The use of ribs also will provide lower overall weight than unribbed sections of greater thickness. Many zinc die castings are as thin as stampings, yet can be produced in shapes that cannot be duplicated in one-piece stampings—and at lower die cost (Figures 1 and 2).

Wall sections should be designed as nearly uniform in thickness as possible. Where variations in section thickness are necessary, the transition should be gradual rather than abrupt. Unequal cooling and contraction will result in distortion of the die casting where sections are not of uniform thickness. A type of coring called "metal saver" may be used to core out parts of the casting that would otherwise be solid or unnecessarily thick.

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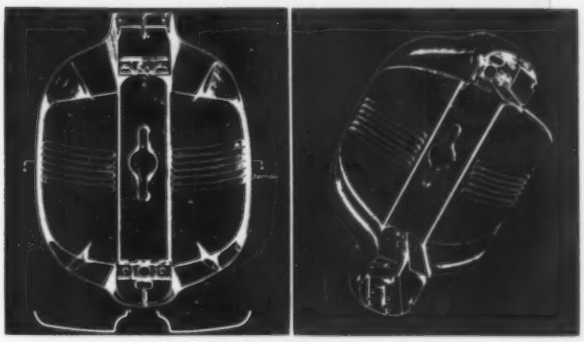


FIGURE 1.

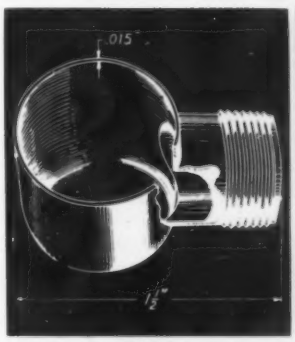


FIGURE 2.

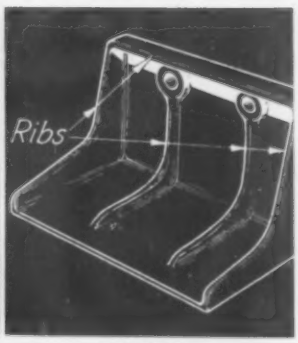


FIGURE 3.

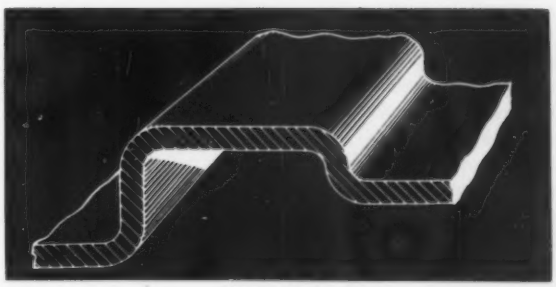
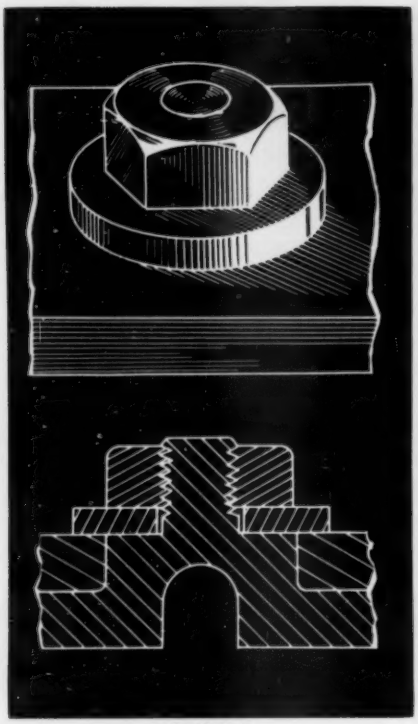


FIGURE 4.

Prepared for Precision Metal Molding by
The New Jersey Zinc Co.



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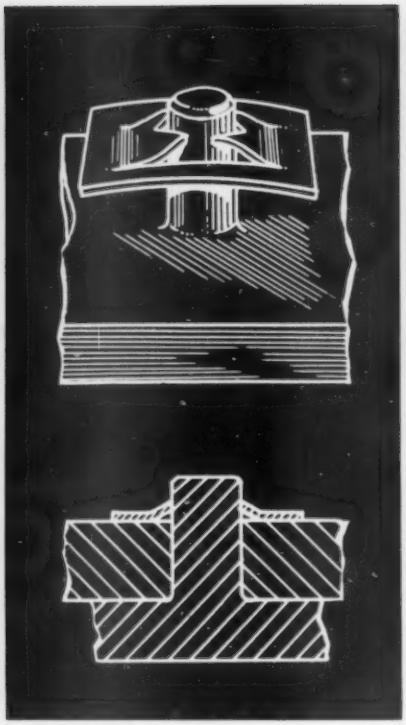

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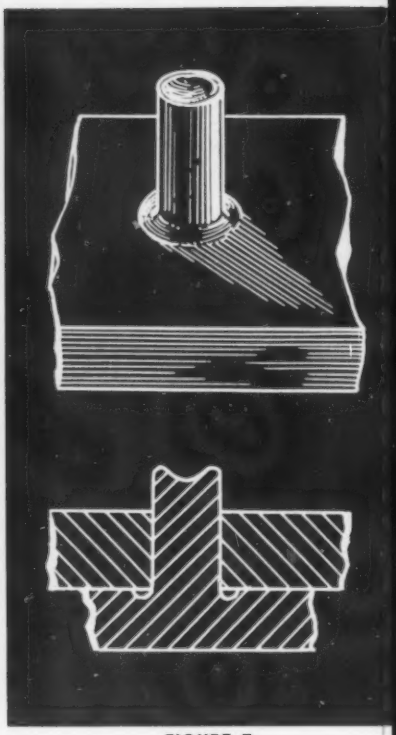


FIGURE 7.

Where bosses or similar metal concentrations are required, they will be heavier than adjacent thin walls and result in unequal shrinkage. This will sometimes create "shrink marks," which are actually depressions on the face of the casting, opposite the thickened section. This shrinkage, or shadow mark, effect can be minimized by making the variation in thickness as small and as gradual as conditions permit. Where such marks may appear on a surface receiving a bright, lustrous finish, they can be masked by ribs or low-relief designs.

RIBS AND FILLETS

Ribs not only help to keep castings from deforming when hot, but serve the same purpose during trimming and other subsequent operations, strengthening and stiffening the casting in service, while adding comparatively little extra weight. Ribs are often joined to bosses at points of load concentration, helping to distribute the stress over a larger portion of the casting (Figure 3). Ribs or beads can also be used for decorative purposes and be further justified by assisting the flow of metal to fill out thin sections in die casting the part.

Even the smallest fillets have an appreciable strengthening effect and should always be used to avoid sharp corners in the casting. Figure 4 illustrates the use of liberal fillets on inside and outside corners without change in section thickness at any point. A minimum radius of .015" is advisable in place of sharp corners and larger radii are desirable when circumstances permit. A slight radius on outside corners will help reduce die costs, make buffing, polishing and plating easier and promote durability of any subsequent finish.

STUDS AND BOSSES

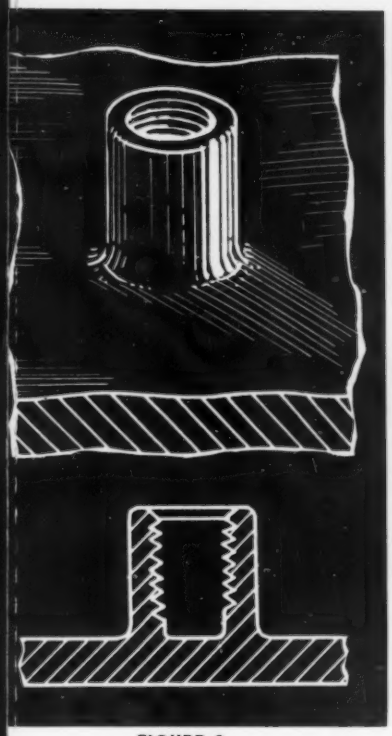
Studs formed as an integral part of the casting usually cost less than inserted studs and are a highly economical means of fastening a casting to a mating part. If such studs are at least ¼" in diameter, they will not be easily damaged in handling. With small, light castings, proportionately smaller studs can be used with safety. Studs having their axes at the line of die parting can have cast threads, even though such threads may have to be chased if close fits are required. Speed nuts and clips are a distinct advantage on unthreaded studs where rapid, low-cost assembly is contemplated. All studs must have a liberal fillet where they join the body of the casting (Figures 5, 6 and 7).

Wherever possible, tapped bosses should be used in place of threaded studs because they are stronger. Precautions must be taken, however, to allow tap and chip clearance beyond the last thread of the tapped hole (Figure 8). Holes to be tapped should be countersunk 1/32" larger than the thread to make tapping and assembly easier.

CAST THREADS

Cast threads can be specified wherever their use reduces cost over that of cut threads. There are limitations, of course, usually involving internal threads (B, Figure 9). Most external threads, when coarse and over ¾" pitch diameter (A and C, Figure 9), can be cast and are located at the die parting. After trimming the die casting, the flash may be further removed by chasing to produce a truer thread.

Zinc die castings can be cored to tapping size, an advisable procedure for all fine-thread holes and those requiring coarse threads under ¾" diameter.



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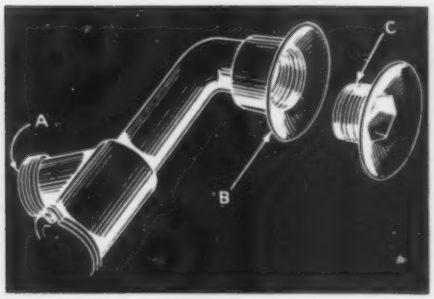

FIGURE 9.

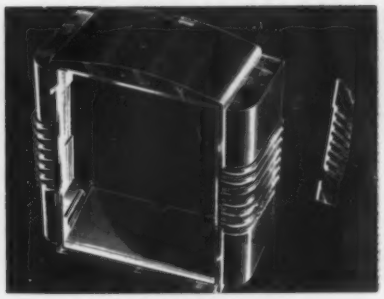

FIGURE 10.

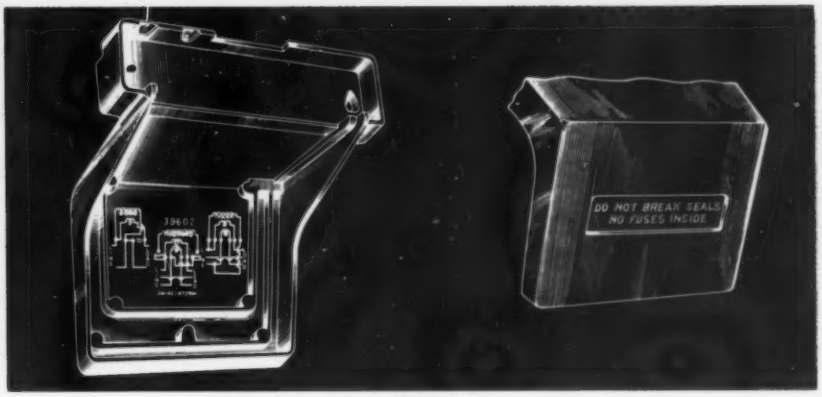

FIGURE 11.

Again, the die casting engineer should be consulted before deciding whether to cast or cut threads.

FLAT SURFACES

Plain surfaces of any size should be avoided if they must be cast exceptionally smooth for finishing. Imperfections are magnified by glossy finishes and rejection rates will be high unless measures are taken to disguise or prevent slight blemishes. Surfaces may be curved, crowned, stepped, beaded, or decorated to break up flat areas and improve appearance (Figure 10).

LETTERING

Die cast lettering, trade marks, numerals or instructions can be designed to appear in suitable surfaces of the die casting provided they facilitate die construction and the removal of the casting from the die. Normally, raised engraving is easier to cut into a die surface than a raised design on the die. Debossed engraving is much more expensive in die cost and deterioration of the die than raised messages on the die casting.

Figure 11 illustrates the use of a wiring diagram on the inside of a meter case, with all elements of the diagram cut into the die so the casting will bear the diagram as a raised figure. Engraving is often used very effectively for scale or graduation markings, sometimes wiped in or filled with paint to provide contrast with surrounding areas.

CORES

Cores are used to keep section thickness relatively uniform and to provide accurately sized holes precisely located in the die casting. Although usually fixed so that their axes are parallel to the motion of the die, cores can be placed at other angles but must then be made movable so they can be retracted before the die is opened. This will result in increased die cost, but may be justified. Pointed cores are often used to advantage for spotting holes for drilling.

INSERTS

Inserts may be placed in the die and the casting formed around them or they may be applied after casting in holes cored for the purpose. Casting the insert in place will give it a firm anchoring position where, perhaps, it could not be placed afterward. Inserts designed for casting in position should be provided with knurling, holes or grooves to insure a firm anchorage in the casting. Provision must also be made for a sufficient thickness of material around the insert to give it adequate support.

DRAFT ALLOWANCES AND TOLERANCES

Drafts are necessary in order to eject the casting from the die. Though drafts can invariably be less than for sand castings, they should not be made so small as to cause distortion by interference with core pulling or ejection of the casting. The draft should not be designed so close as to interfere with satisfactory casting practice.

Tolerances of zinc die castings should never be specified closer than required to meet essential purposes. It costs much more to hold close dimensions than to allow somewhat wider limits, hence there is no point in demanding close tolerances when they serve no useful purpose. When tolerances closer than common are essential, the die casting engineer should be consulted to determine whether they can be held.

Designing for DIE CASTING

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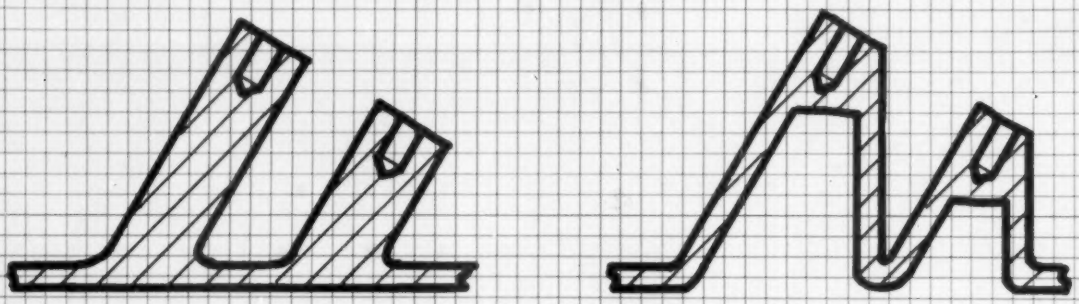
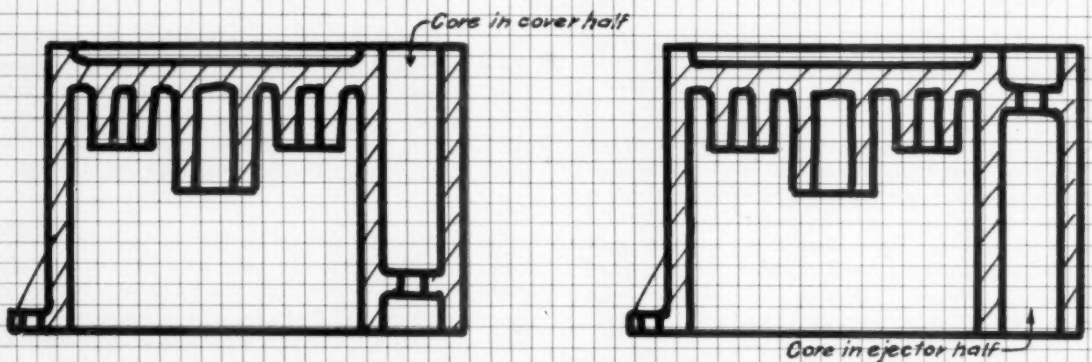
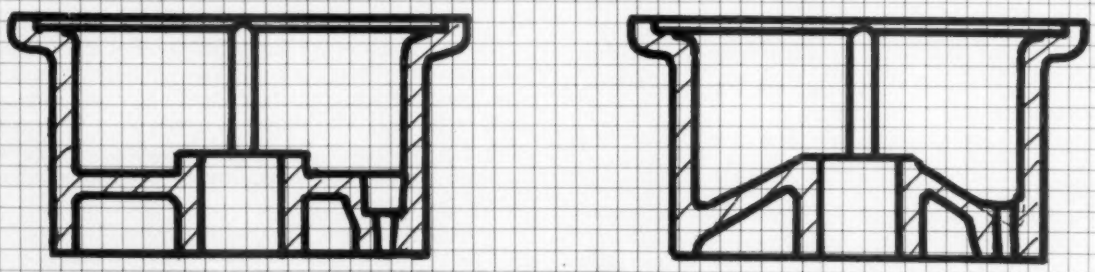


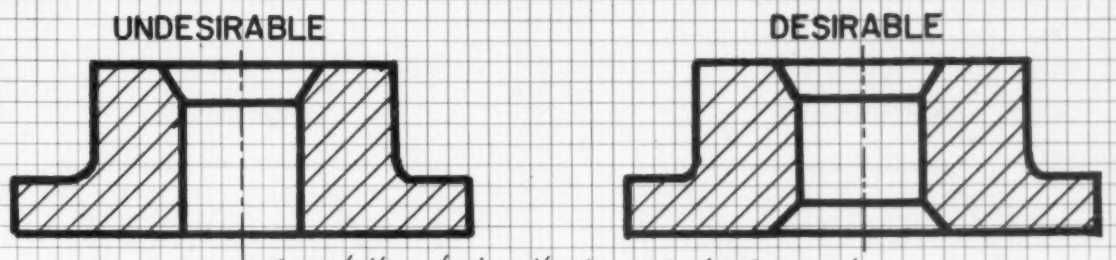
Sloping bosses can be designed for straight die parting to avoid expensive die construction.



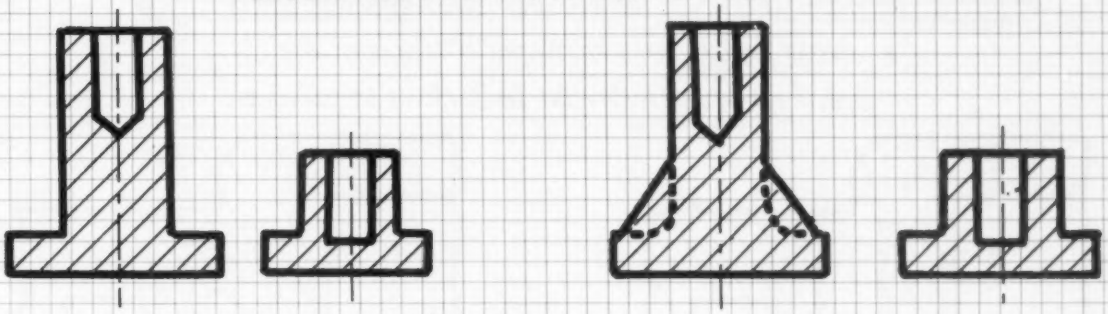
Deep cavities should all be on one side of casting where possible.



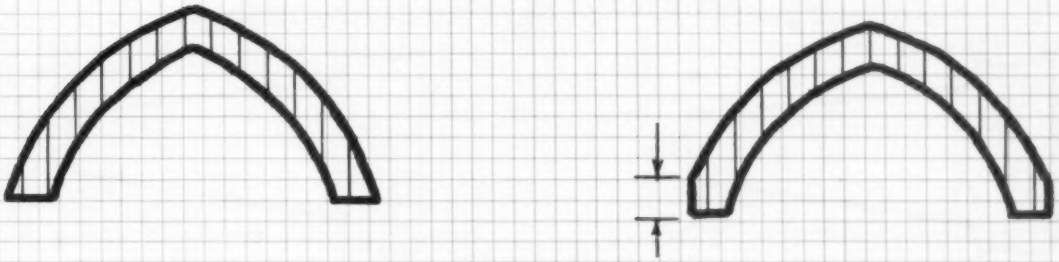
Cavities can often be modified to eliminate binding due to shrinkage over cores.



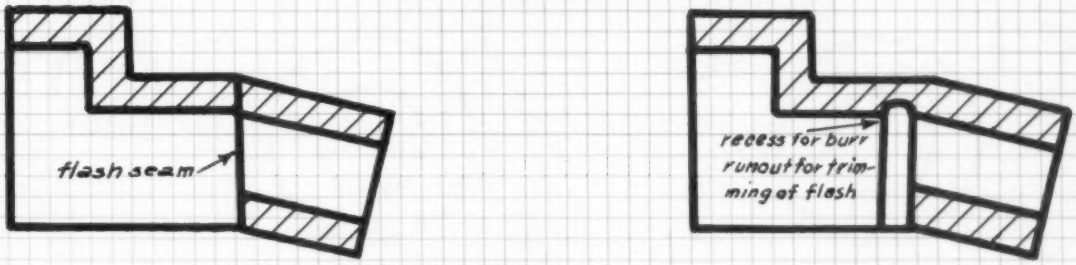
Cored thru holes that are to be tapped should have c'sink on both sides.



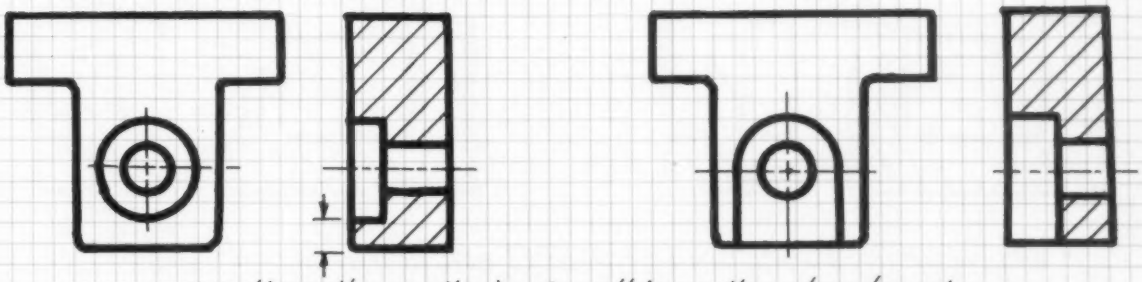
Ribs and/or fillets improve bosses.



Allow .030 min. flat at parting line for gating and trimming.



Simplify flash and burr removal on inside surfaces.



Extending c'bore eliminates thin wall and undercut

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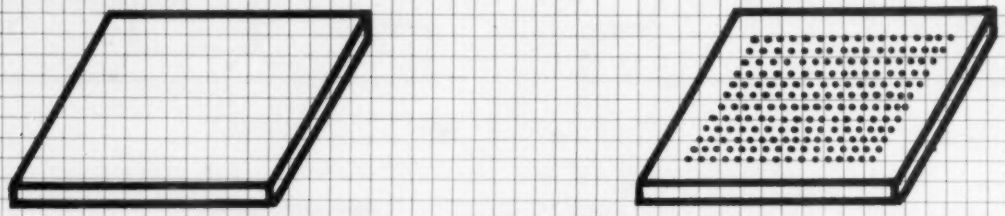
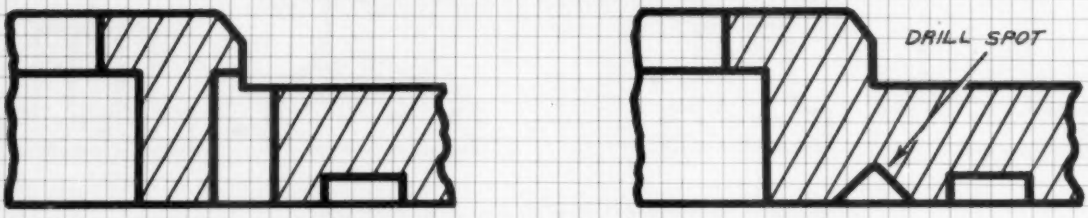
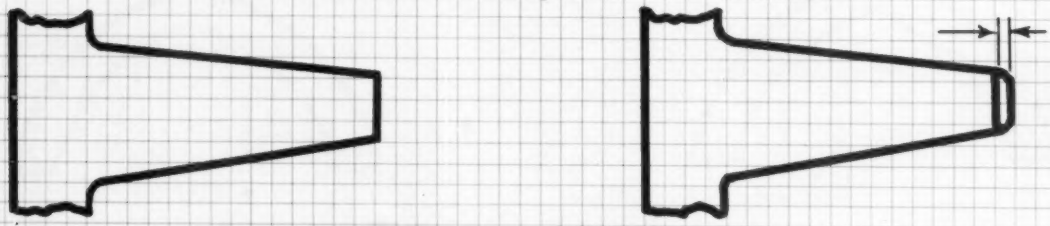


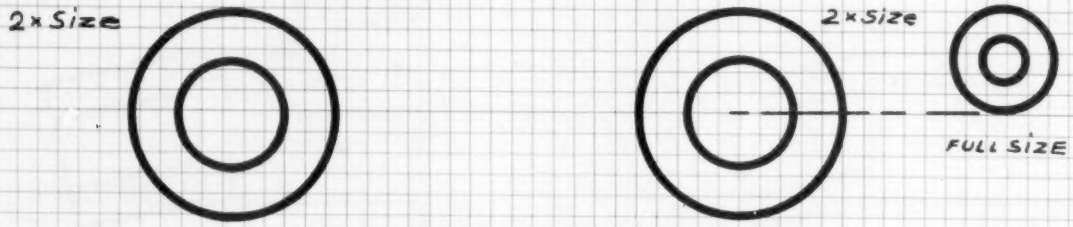
Avoid large, plain surfaces. Where possible, break up areas with ribs, serrations, stippling, etc.



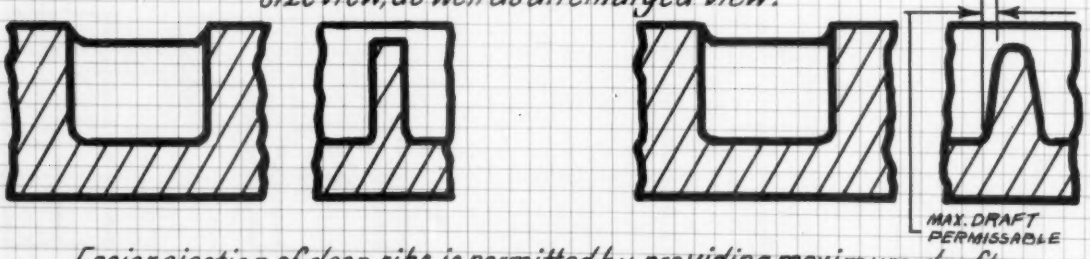
Casting drill spots is often preferred to attempting to core a through hole. Offhand drilling from a spot is simple.



Extra stock should be allowed for machining ejector or vent marks from deep sections.



In drawing it is desirable to have a full size view, as well as an enlarged view.



Easier ejection of deep ribs is permitted by providing maximum draft.

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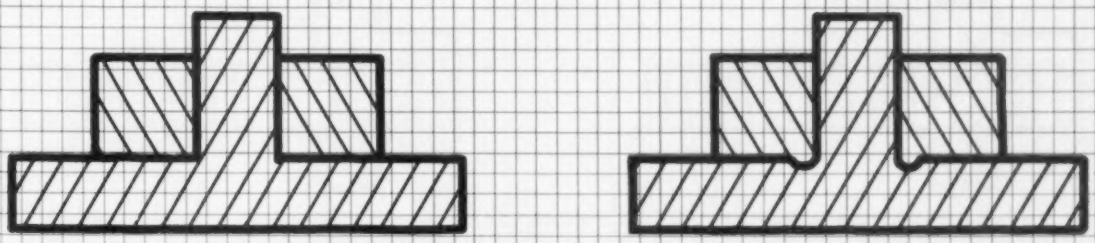
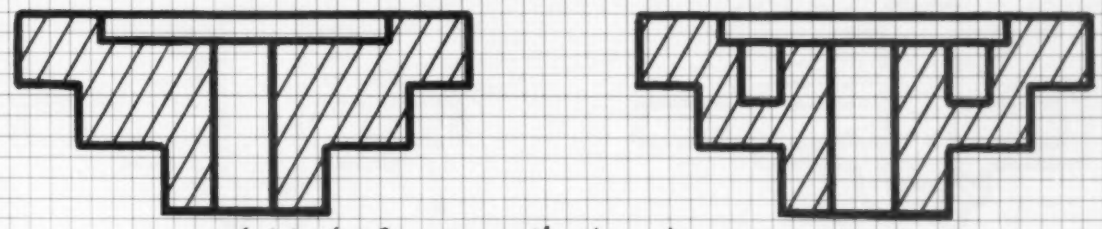
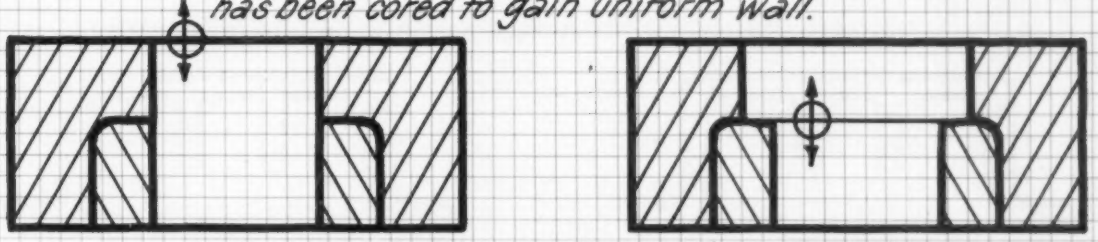


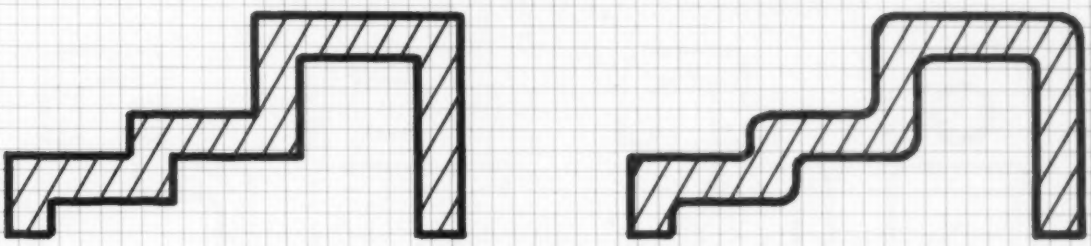
Where corners must fit together on two castings allow a relief.



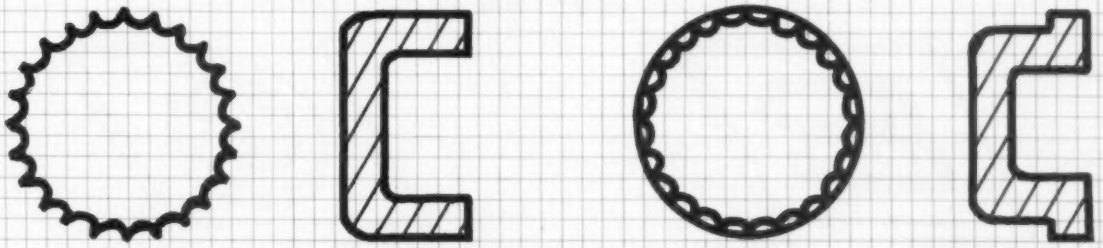
Add ribs for strength where heavy section has been cored to gain uniform wall.



Split core to hold insert firmly during casting.



Provide maximum radius on all corners.

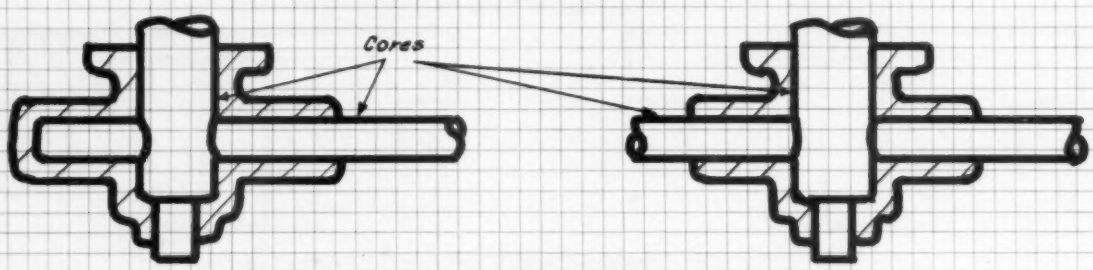


Provide bead on scallop to simplify gating and trimming.

UNDESIRABLE

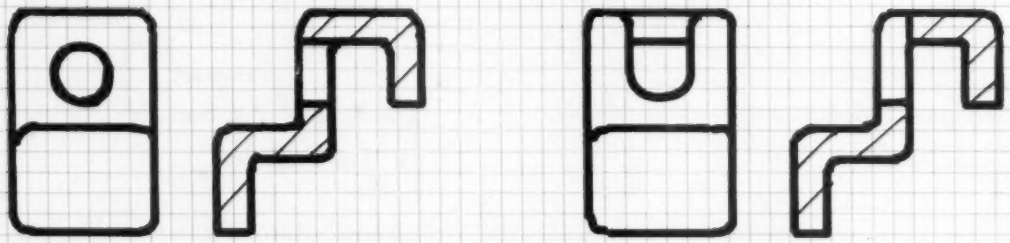
DESIRABLE

To prevent flash in threads of inserts, leave space between surface of casting and the threads.



Interlocking cores are rarely justified. Preferred design... two small cores bearing against a larger core.

Avoid moving cores that must fit accurately in both die halves. Drill holes in inner brackets.

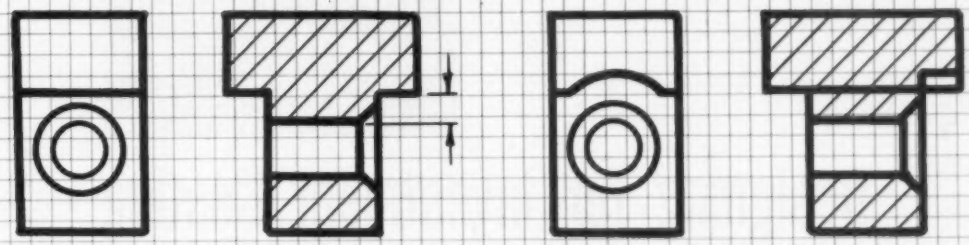


Side cores can often be avoided by this hole design.

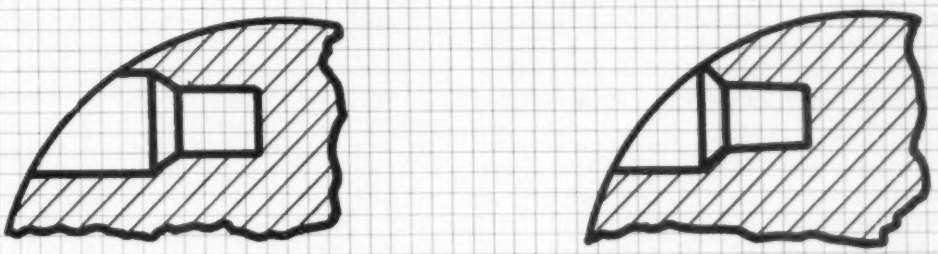
Raised lettering is simple to cut into the die, depressed lettering can be produced but costs more.

UNDESIRABLE

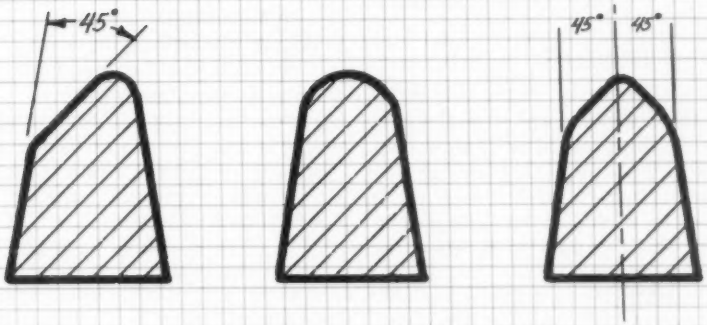
DESIRABLE



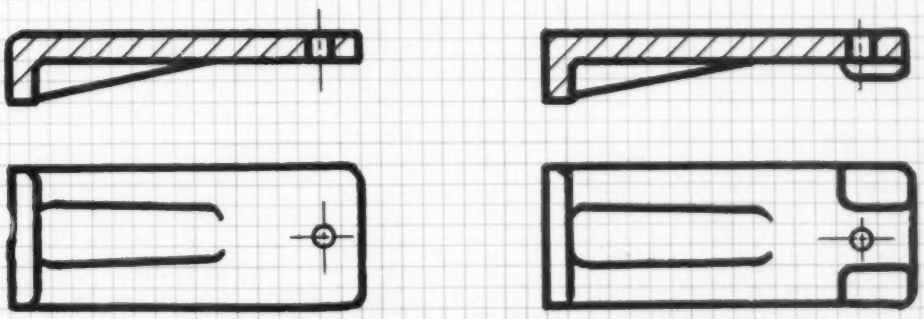
Avoid thin walls in die around cores.



Thin cast section is difficult to fill.



Some contours are easier than others to mill into die.



If possible, provide bosses to relieve tension on core.

Designing for Investment Casting

INVESTMENT CASTING permits the designer to work outside the limitations of machinability. If the tolerances and the surface finish that can be achieved in the as-cast condition are adequate, then impossible to machine shapes, cored holes that can not be reached and other machining impossibilities can be incorporated into the design.

But there are other design advantages gained from investment casting. Two or more parts which would normally be joined by welding, brazing, soldering, or mechanical fasteners can frequently be cast as a single unit. This comes through the ability of the investment foundryman to weld together wax or plastic patterns. About the only limitation on complexity of design is whether the molten wax will drain out completely during the burnout period. Theoretically, at least, if the wax will drain out, the resultant cavity can be filled with metal.

KNOW THE CASTING PROCESS

As in almost every other casting method, it is almost mandatory that the designer have a good working knowledge of the casting process, or that he consult with a skilled foundryman during the design stages. Otherwise, non-castable designs will often result; or the design will be such that the casting must be gated on a surface which is later to be used for either a machining or assembly reference.

Frequently it is essential that two heavy metal sections be joined by a relatively thin section. When this is the case the heavy sections must both be gated for adequate metal feed.

Some dimensions are critical, others not. Only the critical dimensions should be held to tight tolerances. This will insure accuracy where it is really needed.

SELECT CORRECT ALLOY

As design complexity increases, the choice of metal or alloy in which the part is cast must be examined. If there is a lot of fine detail, thin sections and other difficult to cast requirements then a more fluid alloy must be used than might otherwise be selected. The published tables of properties (see PMM, April 1959) generally give the castability of the different alloys and these tables should be used when alloy selection is made. For example, an intricate part to be cast in a copper base alloy would preferably be made in beryllium-copper rather than one of the castable, but more sluggish, straight brasses or bronzes. The increased cost of metal would be more than offset by the lower number of rejected castings.

While the initial tooling for investment casting may, in some cases, seem quite high the decrease in subsequent machining costs and assembly costs will generally more than offset this higher tooling.

Remember, investment casting need not be considered as exclusively either a high or low production method. Depending on the part to be made, investment casting can be used to make either one part or many thousand duplicate parts.

WHEN TO INVESTMENT CAST

In design, then, investment casting should be seriously considered:

- for intricate and complex shapes which are difficult to machine or fabricate.
- when you can re-design several machined parts into one investment casting.
- when design is likely to change.
- when you can re-design an assembly of stampings or die castings into a single investment casting.
- when you can improve your product with a hard-to-machine alloy.
- when re-design will save weight.
- when good surface finish will improve your product.
- for simple parts which require secondary machining.
- when reduction of welding, brazing, soldering or other fastening is desirable.

The cost of any investment casting will be directly related to the dimensional requirements called for in the blueprints. The following suggested tolerances are those most foundries can meet and still give you castings at the lowest possible cost. Any marked departure from these will increase the cost of the castings.

The following dimensional tolerances and design pointers are published through the courtesy of the Investment Casters Society, Los Angeles, Calif.

DIMENSIONAL TOLERANCES

Experienced users of investment castings have taken maximum advantage of the process by specifying

practical dimensional tolerances. The standard blueprint tolerance call out of –

xxx ±.005″
xx ±.010″
Fract. ±.015″

usually leads to "over-tolerance" and may result in unnecessary rejections.

It is recognized that some dimensions are more critical than others and should be called out by proper tolerances.

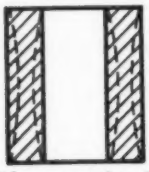
Investment casters can usually meet ±.005 inch per inch, although ±.010 inch per inch is more desirable. The following are recommended design tolerances:

LINEAR

Length	General	Critical
1″	±.010	±.005
2″	±.015	±.010
4″	±.020	±.015
6″	±.030	±.020

CONCENTRICITY

Concentricity between I.D. and O.D. will usually fall within the diameter dimensional tolerances. Normal process variables may produce thinner walls in mid-section, as follows:



Wall Thickness	Thickness Variation
.250″	.005″
.500″	.010″
1.000″	.015″

If a straight diameter is required, allowance should be made for machine or grinding stock after part has been straightened by foundry.

FLATNESS & STRAIGHTNESS

Thick sections have a slight tendency to cavitate, or "dish", and as a result flatness as normally found on a machined part may be absent. This "dishing" may range up to .005, depending on the total area and thickness. At the same time, the part as a result of its shape, or heat-treatment, may warp and require mechanical straightening. The following tolerances can be met, disregarding the "dished" area:

Length	F.I.R. As Cast	F.I.R. Straightened
2″	±.010	±.005
2-4″	±.015	±.010
4-6″	±.020	±.015
6″	±.030	±.020

OUT-OF-ROUNDNESS

Tubular parts which can be mechanically straightened fall within general casting tolerance of ±.005 inch per inch.

GATE AREAS

Removal of gate or gates with a shadow of .010 to .020″ remaining can be accomplished simply. Flush removal, or to a contour, calls for additional tolerance allowance on the minus side. An additional –.010″ is desirable. Gate locations are dictated by section thickness. Normally, castings are gated at heaviest sections to permit directional solidification of the metal to produce soundness.

PERPENDICULAR AND PARALLEL SECTIONS

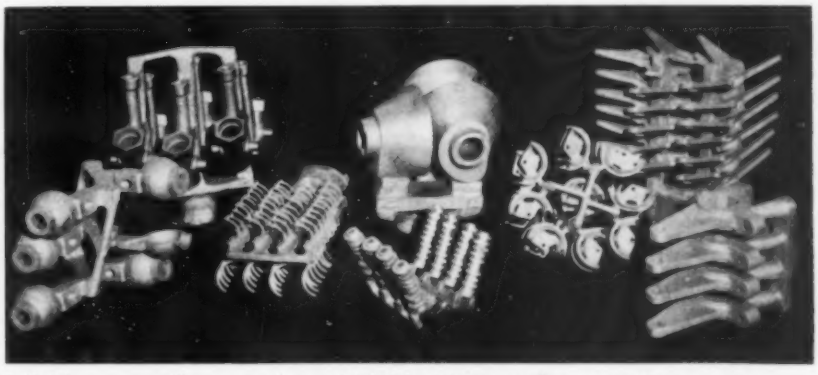
⊥ and ∥ of .005 inch per inch can normally be maintained by straightening. However, if a heat-treatment is involved which results in full hardness, the tolerance limit may have to be relaxed. The same holds true for parts made from 420 to 440C alloys which have low ductility even in the annealed state.

ANGLES

Angular tolerance of ±½° are normally held.

GENERAL COMMENTS

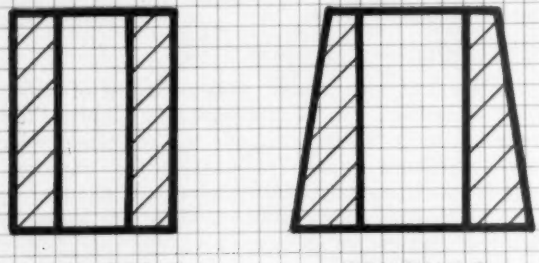
The above observations on tolerances are based on results that are currently being obtained on castings. Years ago, when the castings being produced were much smaller, it was thought that tolerances of ±.003″ and under could be maintained and the misnomer of "precision" was attached to castings produced by the lost wax or investment casting process. The process was oversold on the basis of "precision". Years of experience have shown that the process is capable of economically producing intricate, close tolerance parts as is evidenced by the millions of investment castings being purchased annually.



TYPICAL INVESTMENT CASTINGS (left) are generally cast in clusters (right) by joining together wax or plastic patterns.

Designing for INVESTMENT CASTING

Taper cylinder walls to produce soundness in parts over 2" in diameter and longer than 6"



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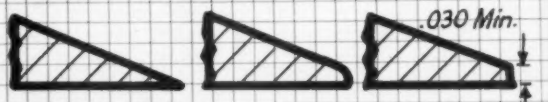
Avoid sharp, razor-like edges



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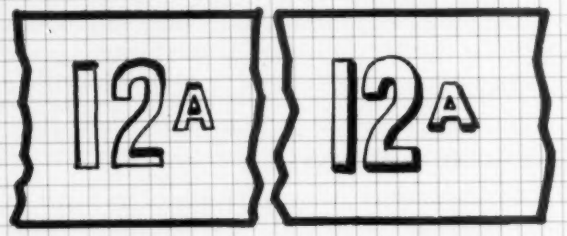
Practical Tolerance

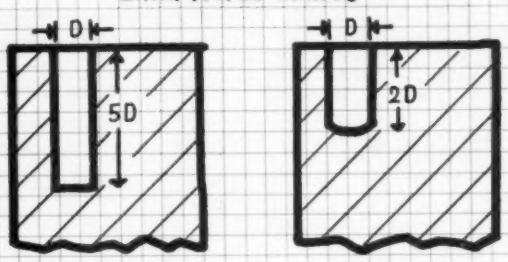
±.003 for dimensions .00–.25
±.004 for dimensions .25–.50
±.005 for dimensions .50–1.00
±.005/inch for each linear inch over 1.00

This is a good rule of thumb – closer tolerances can be held dependent on design and material

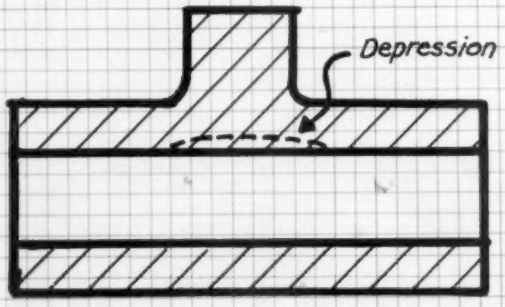


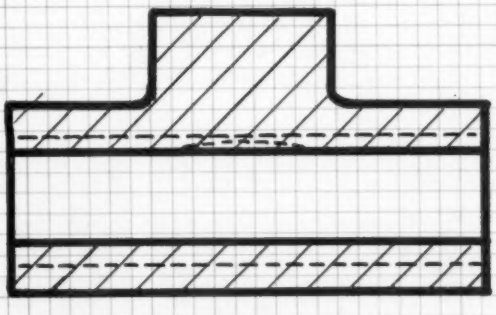
Depressed part number more expensive *Raised part number more economical*

Blind Holes Limits



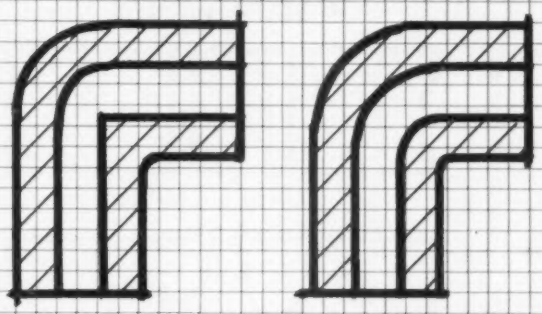
NOT RECOMMENDED RECOMMENDED





Heavy section adjacent to thin walls may result in localized depression, as shown. Allow machine stock when critical. Provide machine stock on cored holes to correct for localized shrink

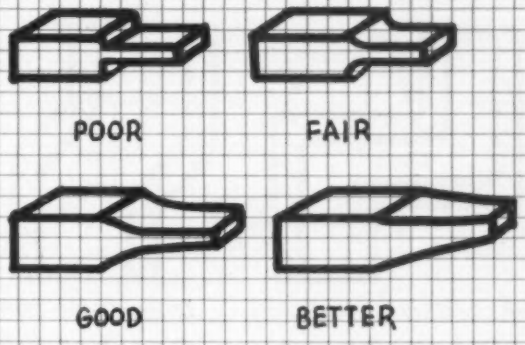
Internal Corners

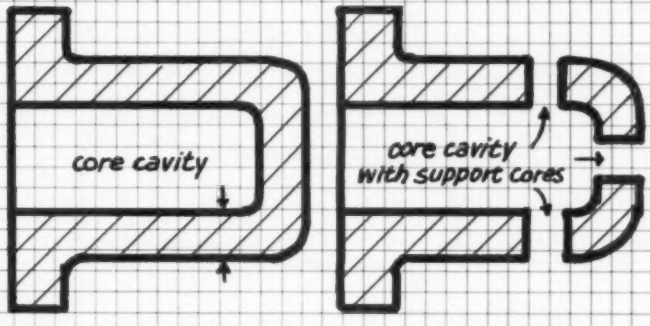


Tooling less — simple 2-core pull

Special tooling necessary - soluble core or assembly

Avoid abrupt changes in section

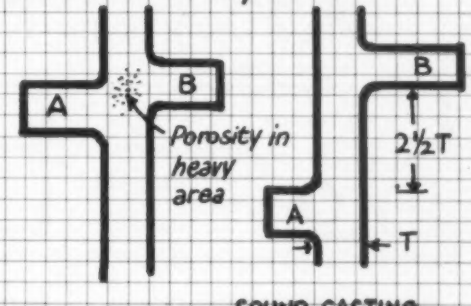




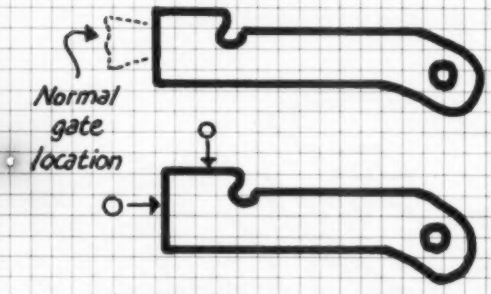
Unsupported cores may result in wall thickness variation. POOR

Uniform walls — Better design.

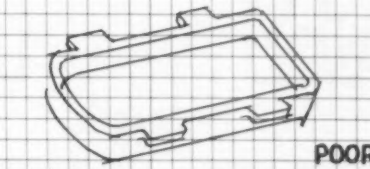
Avoid isolated heavy section



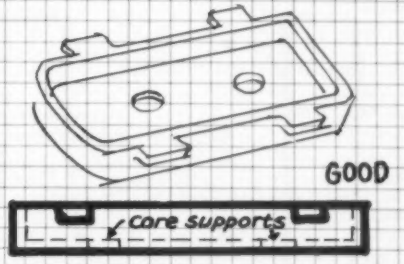
Indicate locating surfaces for machining



Indicate tooling points

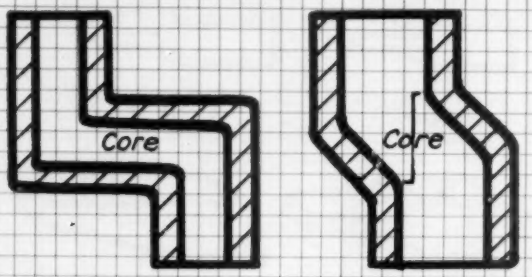


Wall variation - needs core to stabilize



Where possible on large cavities, place core supports to maintain wall thickness.

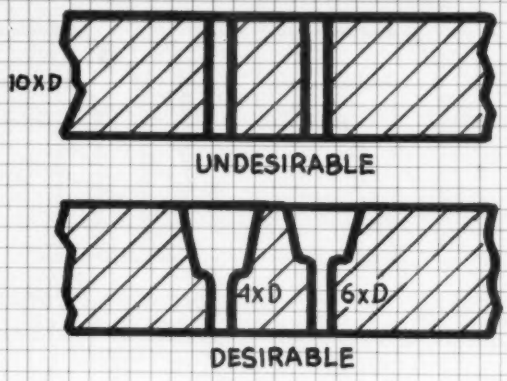
Internal core design for simplified tooling



Expensive tooling - Complex internal coring

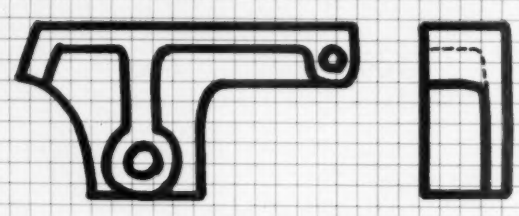
Lower cost tooling - Simplified coring

Through Holes - Length should not exceed 4-6x dia. of hole



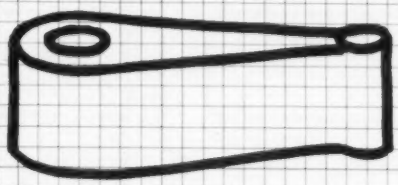
Avoid Heavy Sections

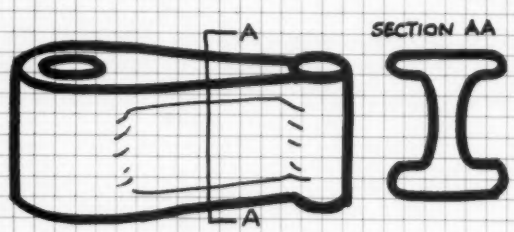
Heavy sections have depressions as indicated



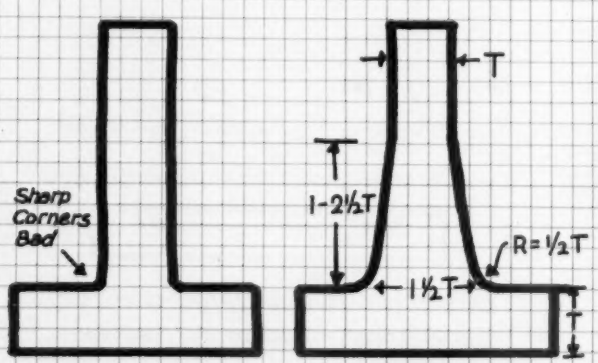
DESIRABLE

Weight reduction without sacrificing structural strength





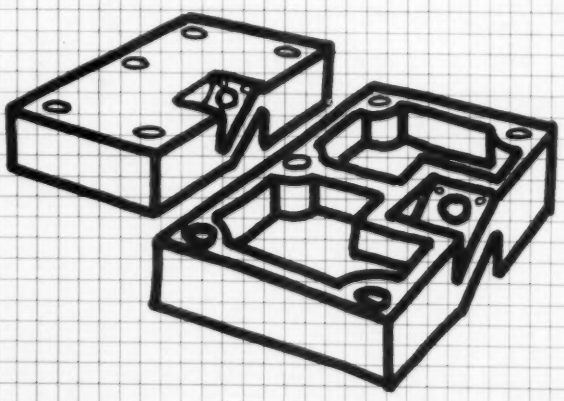
Proper Web or "T" Design



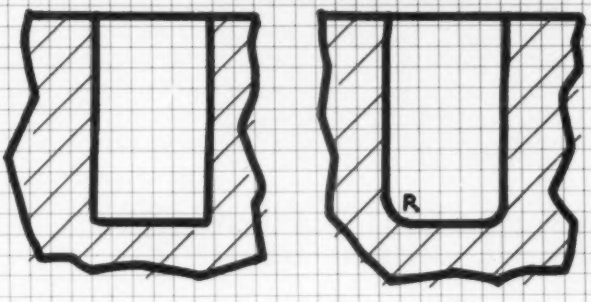
UNDESIRABLE

DESIRABLE

Lighten sections when possible

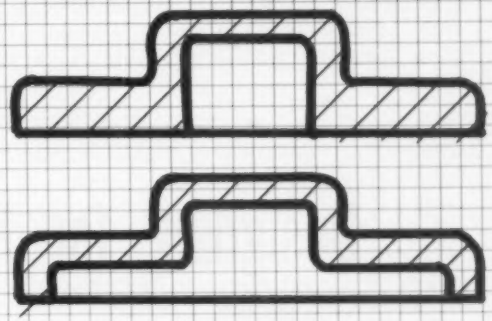


Radius inside corners to improve quality of castings



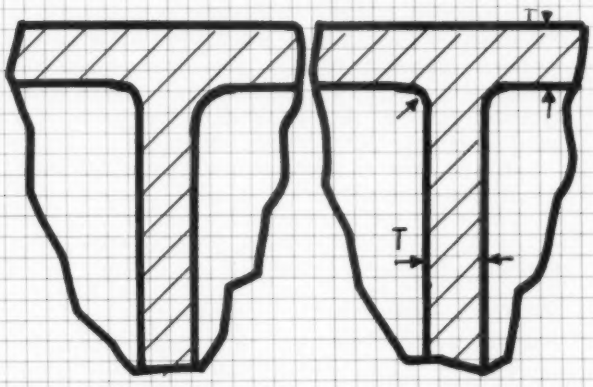
UNDESIRABLE DESIRABLE

Uniform Walls - Radii & fillets improve quality



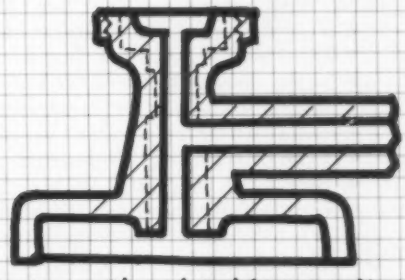
IMPROVED

Fillets

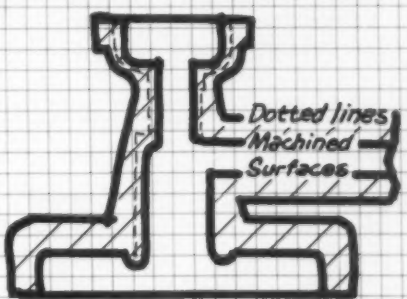


Radical changes in fillet radius not desirable

Fillet radii should be related to thickness specified as .XX Max. (.06 Max.)

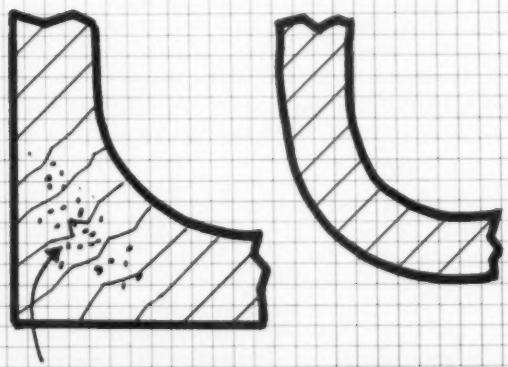


Heavy sections lead to porosity



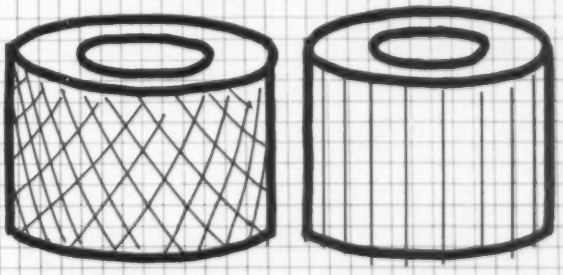
Uniform wall improves casting quality. Allow 1/32 - 1/16 for finish machining

Uniformity of Section



UNSOUND AREA IMPROVED

Knurling Design



UNDESIRABLE DESIRABLE

Designing for Permanent Mold Casting

HOW DOES A DESIGNER choose the casting method and the alloy for a part to be made in aluminum?

Take the selection of alloy first. This depends on many variables, some of these are:

- For what purpose will the casting be used?
- What will be the approximate weight and size?
- Is the design simple or intricate?
- Are there thick and thin sections in the casting?
- What casting process will be used?
- Type of surface finish desired?
- How much machining will be done?
- How will the casting be finished?
- What dimensional accuracy is required?

Then these factors must be considered also:

Hardness, tensile strength, impact strength elongation, dimensional stability, electrical conductivity, thermal conductivity, corrosion resistance, resistance to heat, cold flow resistance, and pressure tightness.

TABLE I

	Sand	Permanent Mold	Semi-Permanent Mold	Die
Close Tolerances	4	2	3	1
Flexibility as to Alloys	1	3	2	4
Flexibility as to Design	1	3	2	4
Limitation as to Size	1	3	2	4
Porosity	4	1	2	3
Surface Smoothness	4	2	3	1
Strength (solid metal not heat treated)	4	2	3	1
Thinness of Section	4	2	3	1
Speed of Getting into Production	1	2	3	4
Rate of Production	4	2	3	1
Possibility to Save Machining	4	2	3	1
Cost of Tooling	1	3	2	4
Labor Cost per Casting (as cast)				
Low production	1	3	2	4
High production	4	2	3	1

Note: The various characteristics are numbered in order of desirability: No. 1 indicates first choice, No. 2 second choice, etc.

Much of the required information can be found in the published tables of properties of permanent mold cast alloys, die cast alloys, investment cast alloys (See PMM, April, 1959).

How to select the casting process becomes a bit more complicated. A start can be made by a comparison of sand, permanent mold, semi-permanent mold and die casting as shown in Table 1.

A study of the charts of physical and mechanical properties, together with the above comparison frequently will show that permanent mold casting is the best and the most economical method of casting for many parts now made by some other process.

But even when permanent mold casting has been selected based on alloy selection and most economical production method, there are still a number of factors within the control of the designer which will aid the foundry in producing sound, low cost castings.

SECTION THICKNESS

From a foundry standpoint, it is desirable to maintain uniform sections throughout a casting. Section uniformity helps to simplify gating and feeding, equalizes the rate of solidification, and helps to prevent cracks and excessive shrinkage. Variations in section tend to set up internal strains in the casting. When it is necessary, for design, to join heavy and light sections, a gradual increase in thickness of the thin section into the heavy section is most desirable.

The thinnest section that can be safely cast in a permanent mold is about ⅛" due to the low melting point of aluminum and hence the rapid solidification. Very short sections thinner than ⅛" can be successfully cast, but always consult a competent foundryman before designing very thin parts. Remember that the pouring temperature of the alloy depends on the thinnest section in a casting and its location with respect to gates through which molten metal enters.

DESIGN OF RIBS

The limitations that applied to section thickness also apply to the design of ribs. Thin ribs, especially highly stressed ones, may, due to rapid cooling, set up excessive stresses in the casting. This may result in a general lowering of strength in the casting and possibly cracking. Generally, the thickness of ribs should be one and one-half times the thickness of the section to which it is joined.

Ribs should be located so that in casting they will not have an undue influence in cooling rates. Generally a square rib is preferred to a rounded one to reduce outer fiber stresses.

When a cast part is subjected to repeated applications of stress in service, ribs may be a source of weakness rather than strength since they may serve to localize stress and thus promote early failure due to fatigue.

FILLETS AND BLENDING

Generous fillets and blendings are valuable to reduce shrinkage and cracking during casting. They also serve to distribute loads more uniformily. However, too large a fillet can be harmful by changing the rate of cooling appreciably with resultant defects due to shrinkage.

In general, when sections of equal thickness are joined the fillet radius should equal the section thickness. When a heavy section joins a thin one a fairly safe formula to follow is:

$$r = \frac{2t + T}{2}$$

where: r = fillet radius
t = thickness of the thinner member
T = thickness of the thicker member

In some cases, it may be necessary to use blending as well as a fillet to secure the best curvature for both foundry and operation reasons. This is generally the case when T is more than 2t.

LOCATING POINTS

Locating points and locating surfaces should be clearly marked on drawings. This serves to insure checking from the same points by both the foundry and the machine shop. It also prevents the foundry from gating the casting on a surface that is to serve as a locating area for machining.

In some cases, center lines can be inscribed in the pattern from which the mold is made to aid in checking. This can not be done on highly stressed castings, the groove could act as a stress raiser and weaken the casting.

FINISH ALLOWANCE

In many cases permanent mold castings can be used in the as-cast condition since tolerances as close as ±0.010 can be held on some selected dimensions. Where machining to final size is required an allowance of 1/32″ is adequate. In sand castings this allowance must be from ⅛″ to ¼″. This difference translates directly into pounds of metal. For example, on a run of castings the weight, when sand cast, was 4 lbs. 6 oz. The same part, when cast in a permanent mold weighed only 3 lbs. 10 oz.

When the castings are semi-permanent mold, i.e. with either sand or plaster cores somewhat greater machining allowances must be allowed, particularly when a sand core is used.

METALLURGICAL IMPROVEMENTS

Properly produced permanent mold castings will have mechanical properties about 20% higher than the same part sand cast. The grain structure is finer and there is far less tendency toward formation of columnar structures, due to the faster rate of cooling. The castings are less subject to shrinkage defects and to gas porosity than are sand castings. Ordinarily, they do not contain any entrapped gas. They are, therefore, normally superior to both sand and die castings with respect to soundness and pressure tightness. In many cases this is the basis for choosing permanent mold castings.

SIZE OF CASTINGS

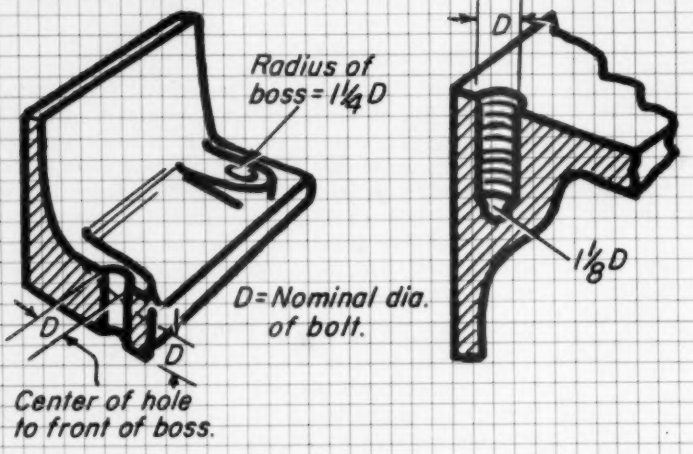
Most castings produced in permanent molds weigh under 20 lbs. However, castings weighing up to 100 lbs. are not uncommon and many have been produced that weigh up to 500 lbs. The weight limitation depends entirely on subsequent economies in machining. Many very large castings can be produced only in sand because of their complexity, also the difficulty of designing and operating a very large permanent mold can be a deterant.

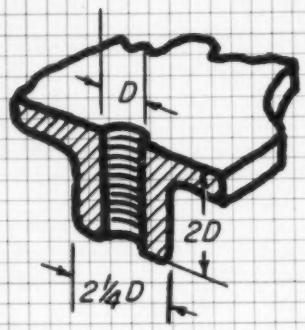
GENERAL DESIGN FEATURES

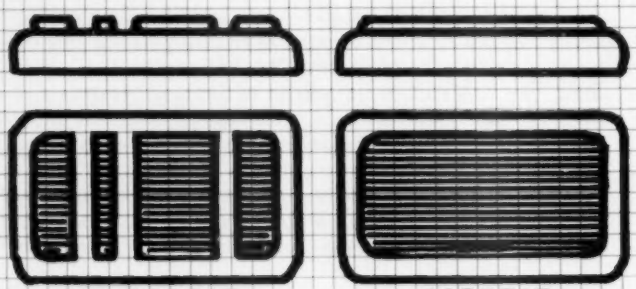
While the designer who has had actual permanent mold casting experience will do a better job of design, here is a recap of a few general considerations that will help the less experienced engineer.

1. Keep the general design as simple as possible. Be sure that it is adaptable to a mold cavity which can be gated to avoid turbulence during pouring and can be risered for progressive solidification.
2. Maintain sections as uniform as possible.
3. Where a heavier section is joined by a lighter section, blend the two into each other with a gradual curve or slope.
4. Don't design so that a heavy section must be fed by a light section. If such a design is needed put the heavy section on a parting line where it can be fed by a riser.
5. Avoid sharp internal corners, use fillets as described above.
6. Use cores only where the extra casting operations, and costs, are more than offset by the saving in machining.
7. All deviations from simple design add to the cost of producing the casting. This is true in the use of collapsible metal cores, sand cores, loose pieces required by undercuts, and extra mold segments necessitated by complexity of casting shape. Such features should be employed only when vital to proper functioning of the casting, where they allow a marked reduction in weight, or when they permit a definite saving in machining cost.
8. The superior soundness and strength of permanent mold castings allows considerable reduction in wall thickness. Where possible reduce walls to ⅛″ to 3/32″ in thickness. If needed, provide stiffening ribs.
9. Watch dimensional tolerances. Don't specify closer tolerances than are absolutely necessary.
10. Be sure to indicate locating points and surfaces on the blueprints so that molds can be built which will not interfere with them.
11. Always consult with a competent foundryman to make sure that your design can be cast with the greatest economy. Don't complicate a casting, and increase its cost, to avoid simple, cheap machining operations.

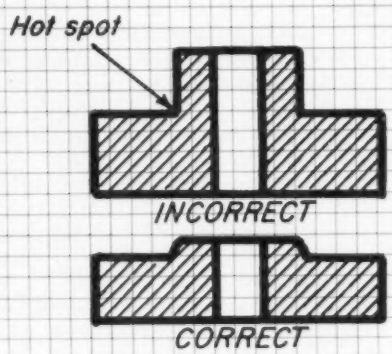
Designing for PERMANENT MOLD CASTING

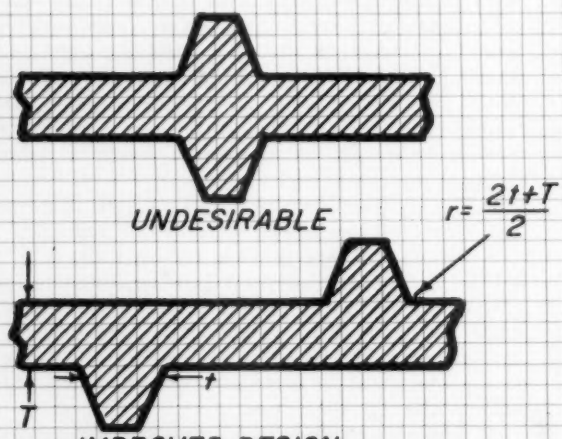




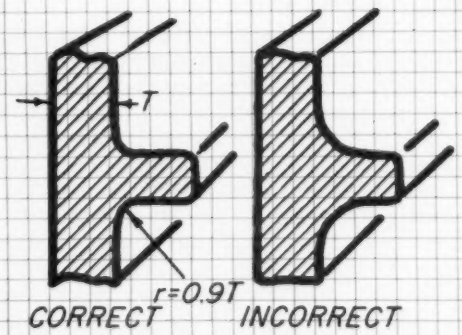


When there are several lugs and bosses on one surface, they should be joined if possible to facilitate machining.

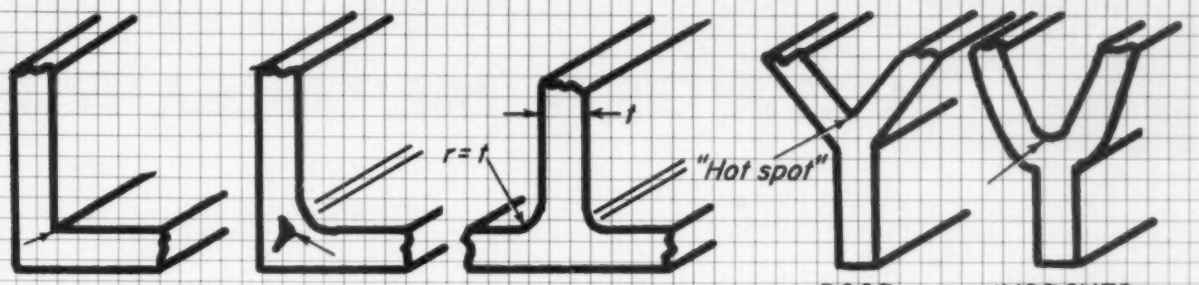




Cross-coupled ribs should preferably be designed as doubled T forms.



Ribs should solidify before the casting section they adjoin. Thickness of rib should be 0.8 to 0.9 of casting thickness.



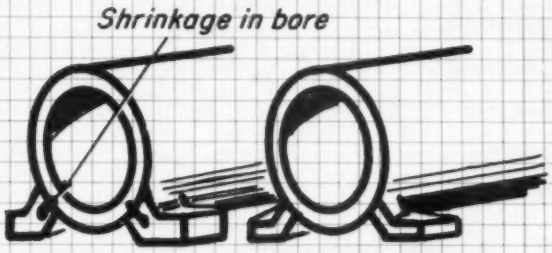
Local structural weakness

To large fillet causes shrinkage

Improved design

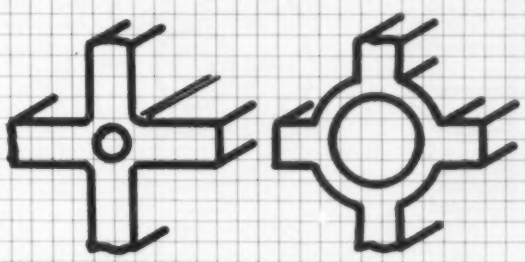
POOR

IMPROVED
Less localization of heat effect



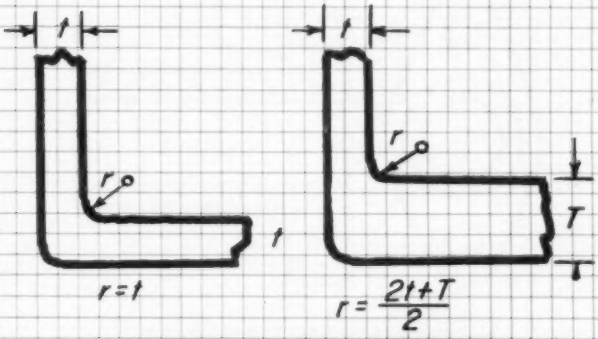
INCORRECT

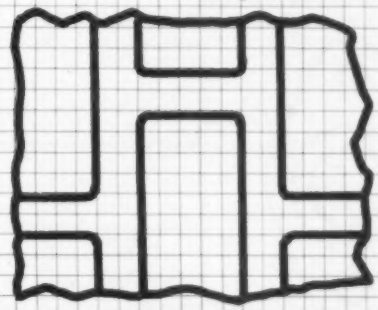
CORRECT DESIGN
Shrinkage weakens foot of cylinder with lugs



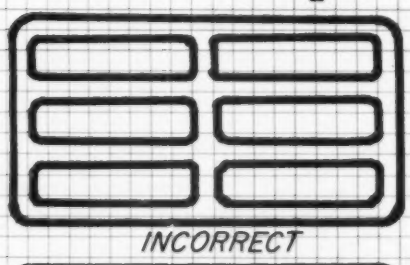
Cored hole speeds cooling at joint

Circular web with ribs is a good design for large flat plates

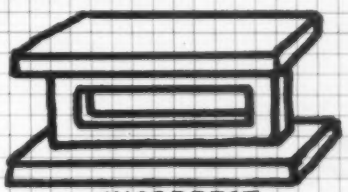




Avoid concentration of metal by staggering cross-members



INCORRECT



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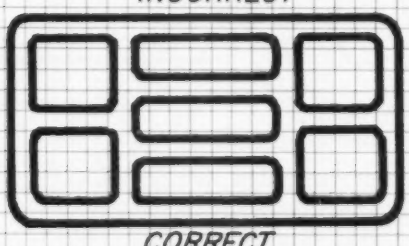
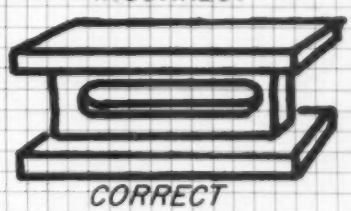


CORRECT
Staggered ribs reduce distortion

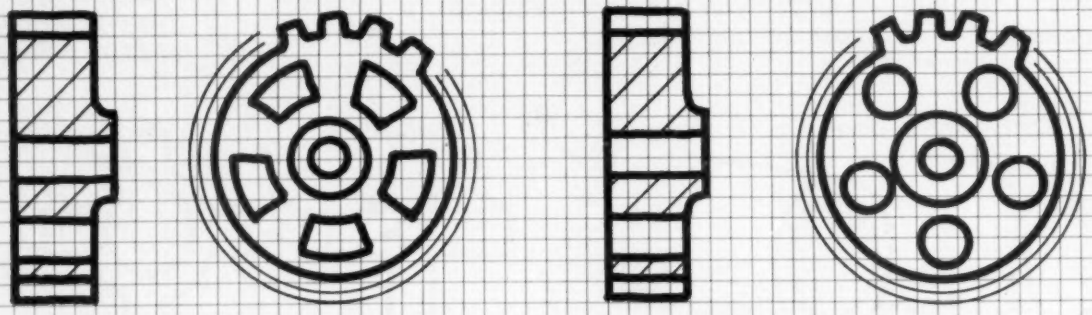


CORRECT

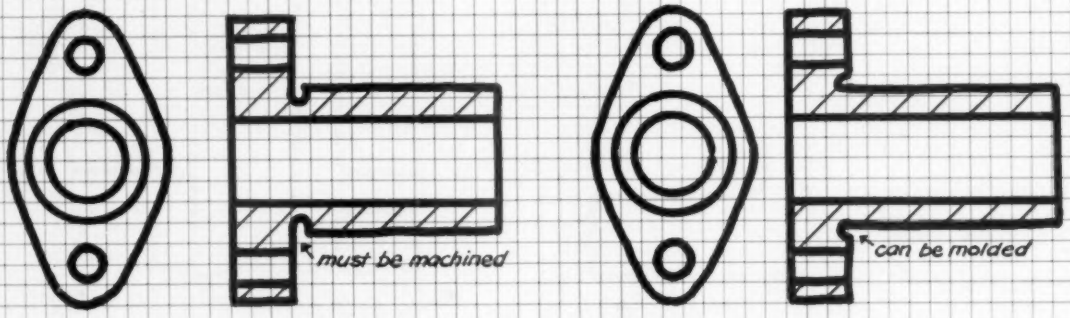
Designing for POWDER METALLURGY

UNDESIRABLE

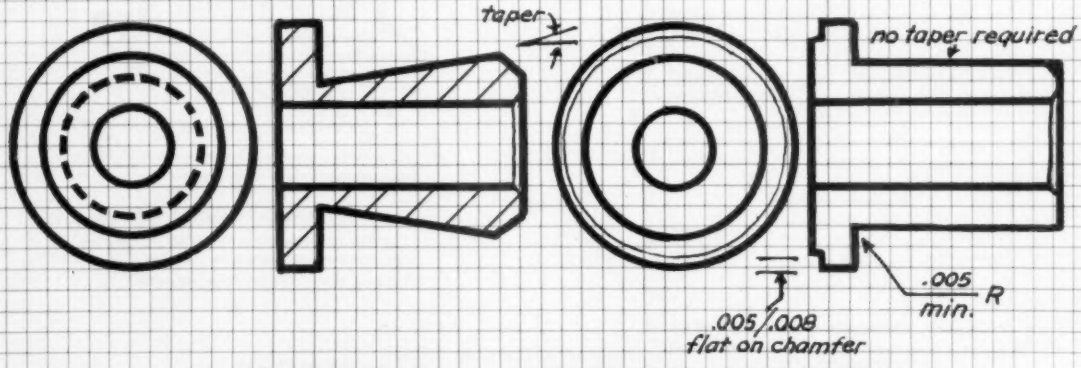
DESIRABLE



Round holes simplify tools, simplify cost.



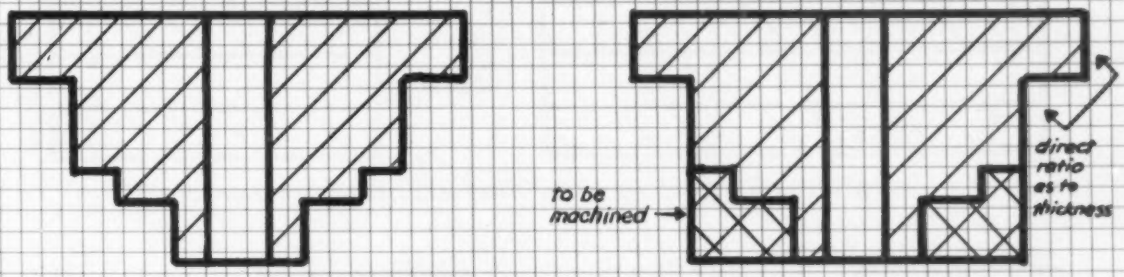
Molded corner relief will save machining.



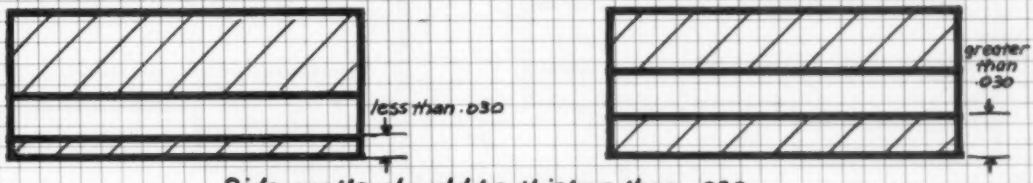
Reverse taper cannot be molded-must be machined

UNDESIRABLE

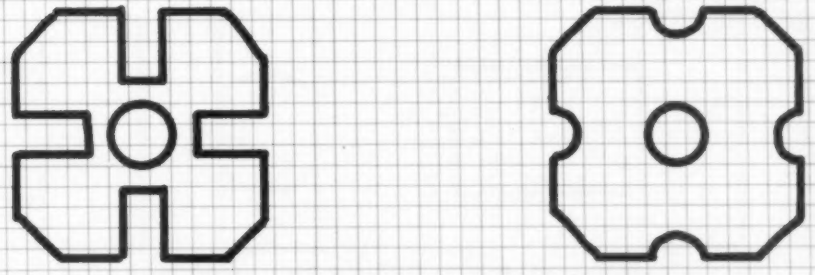
DESIRABLE



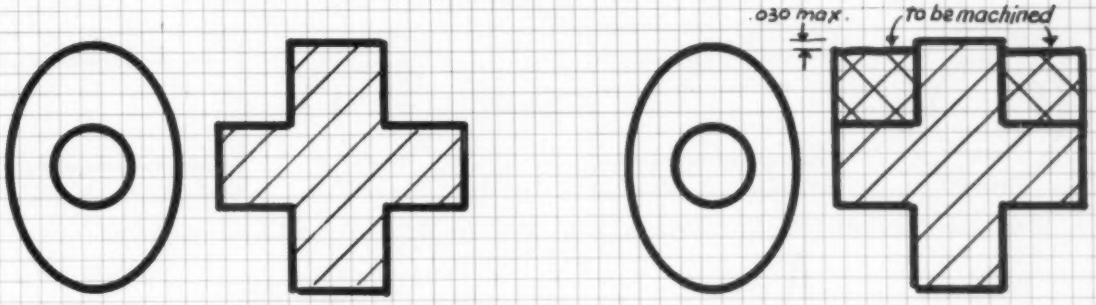
Lower strength results if all stepped diameters are molded.



Side walls should be thicker than .030



Avoid narrow, deep splines in the part.

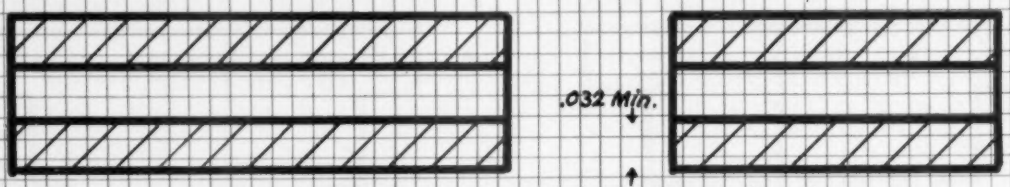


Powder may not flow into upper punch.

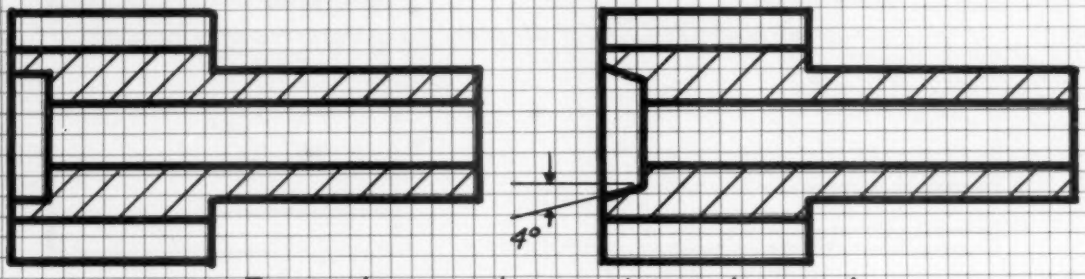
Undercuts cannot be molded, must be machined

UNDESIRABLE

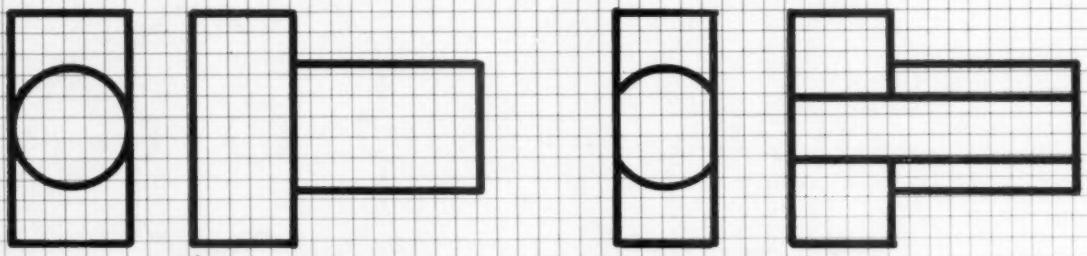
DESIRABLE



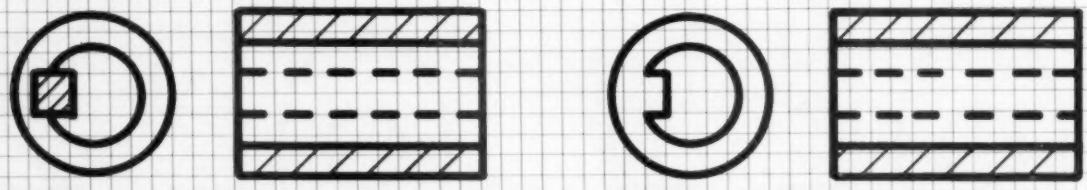
Length should not be greater than 2½ times the diameter.



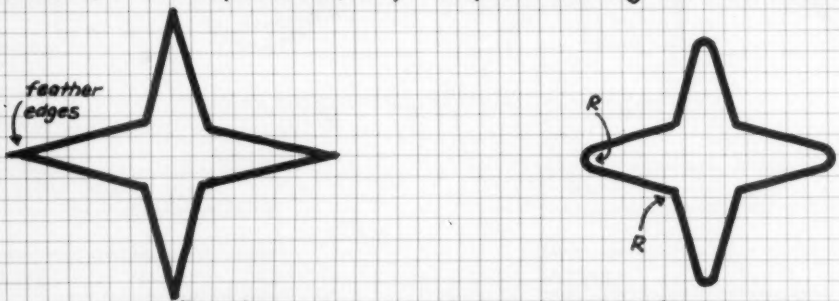
Tapered counterbore assists tool removal.



1/32" minimum flat is necessary on cylindrical portion



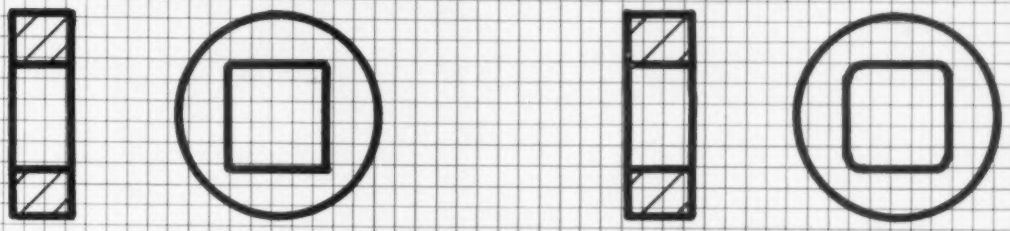
Eliminate separate key and keyway. Keyed bushing can be molded.



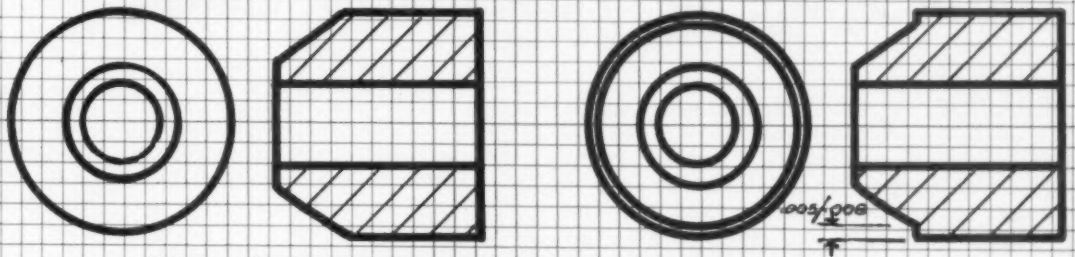
Feather edges on the part should be avoided.

UNDESIRABLE

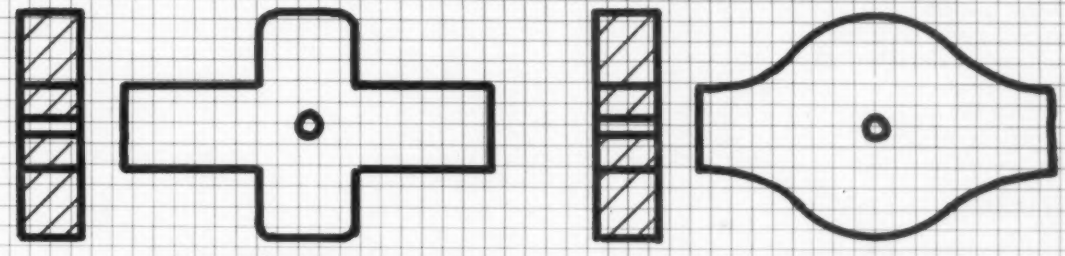
DESIRABLE



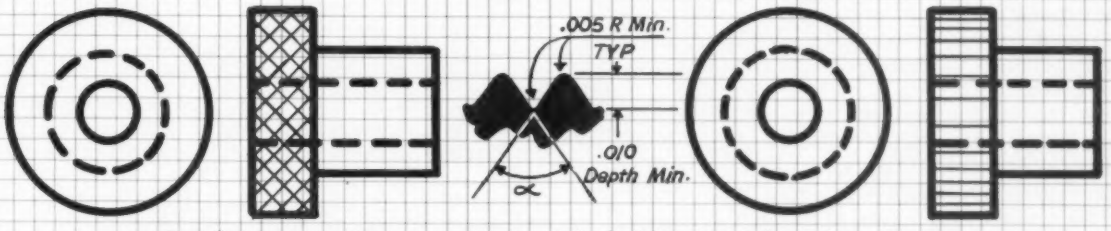
Rounded corners permit uniform powder flow in the die



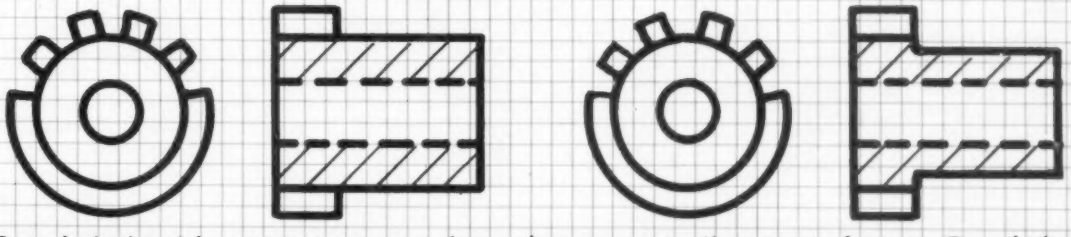
Flats eliminate sharp edges on tools and strengthen die



Avoid designs requiring narrow, deep splines in the die



Straight serrations can be molded, diamond knurl cannot



Gear hub should not be the same dimension as root diameter of gear. Possible but costs more

Designing for Plaster Mold Casting

By W. J. PRESTEL*

EVERY DESIGN ENGINEER knows that designing for maximum efficiency and economy requires some knowledge of every available method of producing product components. By describing some of the advantages, limitations and processes of plaster mold casting, we hope to give you sufficient basic knowledge to enable you to design and specify with authority, using plaster mold castings for components on experimental or production work.

Knowing something of plaster mold castings, and understanding the actual process itself will help you determine when and where to use this type of casting. Also, you'll know how to insure the utmost economy in producing the castings and, most important, how to design and specify plaster mold castings that will keep the cost of the completed product well in line.

OUTSTANDING FEATURES

One of the outstanding features of a plaster mold casting is its unusually smooth finish. Although almost all forms of casting have been improved recently, the finish of a plaster mold casting still leads the field in smoothness. In many instances, plaster mold castings are used as cast, without any machining. In almost every instance, machining time is reduced to the very minimum.

At the present time, it is true that plaster mold castings are somewhat limited in size. The largest flask size available at this time is 12″ x 17″ x 9″. This size can be reduced to a minimum of 8″ x 10″ x 4″ when necessary to insure production economy. The increasing popularity of plaster mold castings will inevitably bring about a larger range of foundry equipment to meet the demand for larger castings made by this process.

A second feature of plaster mold castings is uniformity of the cast parts. The very nature of the materials used in this method of casting, and the operation itself, tends to insure uniformity just as it insures smoothness of finish. Thus, there is far less possibility of rejection of finished parts in the assembly of the complete product when plaster mold castings are used. Uniformity also expedites such machining operations as may be required, since each piece is identical and machining equipment need not be adjusted.

Plaster mold castings are ideal for intricate shapes and thin sections. Here again, the very nature of the plaster mold process makes it possible to produce very complex parts, of any size or contour, as long as they are within the size limits available to this method.

Finally, in the matter of tolerances, plaster mold castings stand pretty much alone in their class. Extremely close tolerances can be held with plaster mold castings, but it is important to note that here, as in any production operation, there is a definite tie between close tolerances and costs. The closer the tolerance, the greater the cost, as every design engineer realizes. Plaster mold castings are regularly produced to a tolerance of ±.005″, but as in all other forms of casting, this very close tolerance cannot always be held over an extended area.

Final tolerances are, of course, influenced by the design of the piece to be cast, but as a general rule, a dimension of 4″ to 5″ can easily be held to ±.015. When extremely close tolerances are absolutely necessary, it would be well to consult with the plaster mold casting producer, who can offer practical suggestions and assistance that will enable you to get the exact tolerances without incurring unduly high costs.

A general rule to follow in specifying tolerances, not only on plaster mold castings, but on all types of castings, is to allow as liberal a figure as possible. In other words, should you have one critical dimension requiring a tolerance of ±.005″, you will effect considerable savings if you will allow some leeway on less critical dimensions. Too often a drawing is prepared using the lowest tolerance necessary not only where needed, but on all other dimensions as well.

In designing a part for plaster mold casting, the draft, to withdraw the pattern from the mold, is very important. This draft requires about .005″ to the inch, although the figure can be reduced as height is increased; however, this is not required when designing a machined part.

Production of plaster mold castings starts with the preparation of very accurate brass patterns, either hand-gated or split brass, mounted on aluminum cope and drag plates. This phase of the operation is basically manual, as extreme care is needed to insure exact conformation and correct size. Prior to pouring, all molds and cores are baked for 14 hours, at 600° temperature. The plaster molds also are handled man-

continued on page 66

*OHIO PRECISION CASTINGS, INC.

B&T DIE CASTING MACHINE CUSTOMERS ARE OUR BEST SALESMEN

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These are the men who will tell you that the B & T clamp four corner toggle system assures high lock-up to the rated tonnage.

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Our customers will assure you that B & T Die Casting Machines lower maintenance costs, reduce scrap and improve production.

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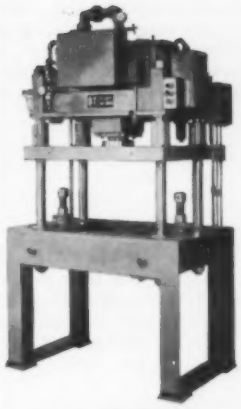

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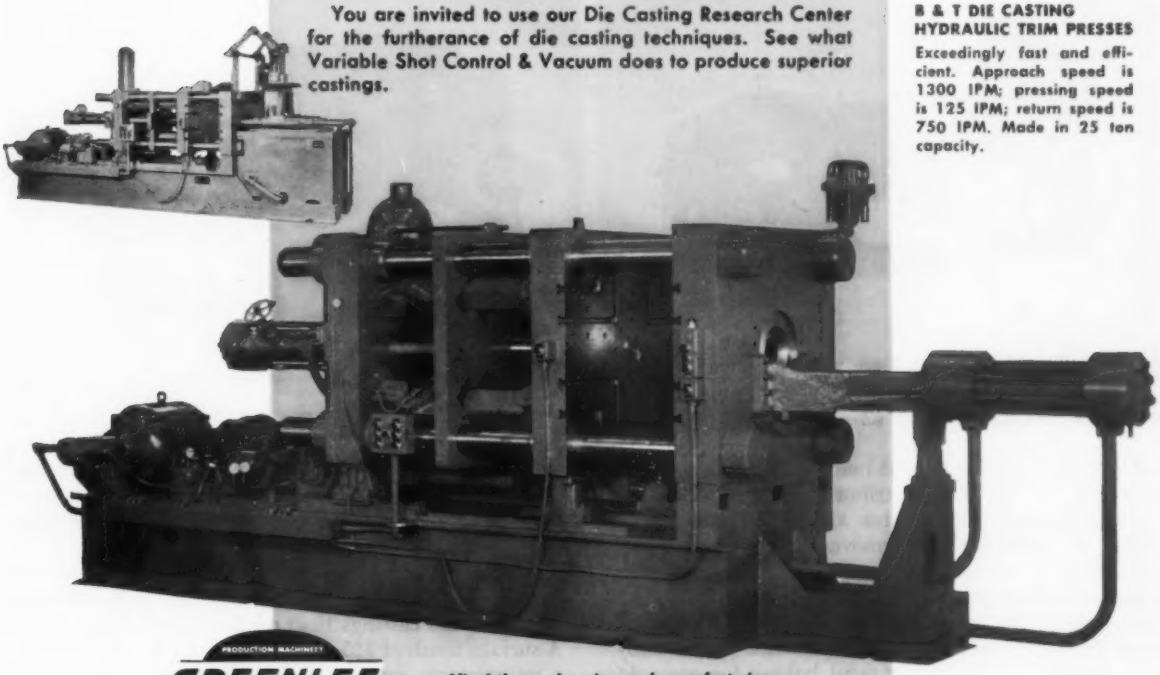

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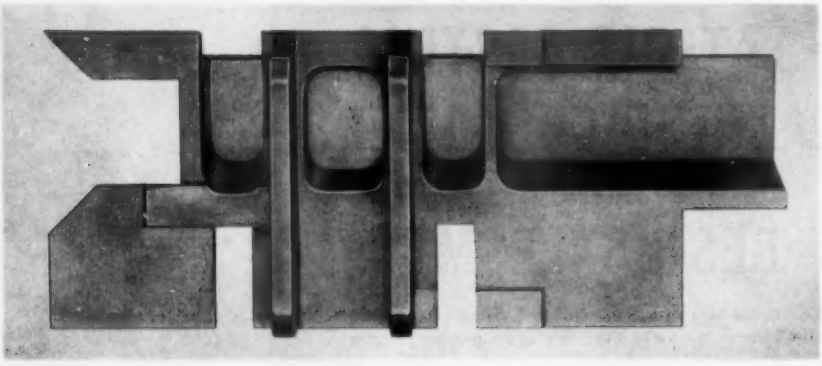
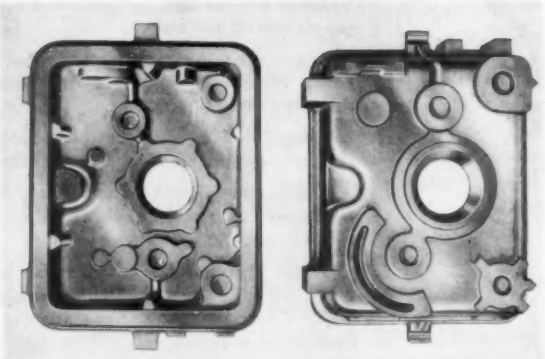
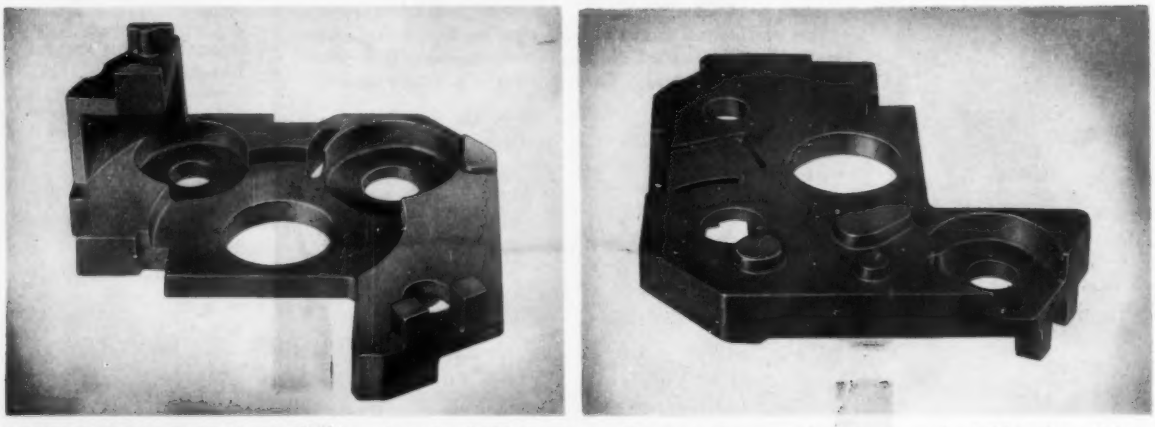


ARTICLE BUCKET is component part of a Redington high-speed, continuous-loading cartoning machine. Made of high-tensile manganese bronze, its intricate shape, smooth finish, and accurate detail eliminate much costly machining.



UNDERWATER CAMERA parts for Fenjohn have unusually tight requirements. Since castings are frequently used 200-250 feet underwater, they must be absolutely free of porosity, must have precise accuracy.



COMPLEX SMALL PART (both sides shown) made of 356 aluminum. Planes, angles, curved surfaces can be held within .005 in.

ually, each half of the mold being poured very slowly to insure smooth, even distribution of the material.

Approximately 22 minutes after pouring is completed, the pattern can be removed. Here again manual methods are necessary to protect the molds from the slightest damage. Molds must be kept at approximately 200° during the pouring, and a similar close control must be maintained on the temperature of the alloy being poured. Following careful baking for some 14 hours, the plaster mold, with fine silicon sand and plaster cores in position, is ready to be poured in metal.

Pouring the metal is a partially-mechanized process, although quite small crucibles are used to maintain accurate control of temperatures. All molds are kept at pre-heated temperatures until ready for metal pouring. If these molds are allowed to cool, it is necessary to re-heat them, a procedure which can affect their accuracy.

Getting back to the matter of tolerances, it should be noted that closer tolerances can normally be held on aluminum castings than on the copper base alloys. A surface finish of 125 micro-inches is typical of aluminum castings; on the high copper base alloys, 160 micro-inches is typical. Generally, plaster mold castings can be produced using aluminum, brass, bronze or beryllium copper. In our own operations, we work with a wide range of alloys, all of which, where applicable, meet or exceed conforming specifications as issued by various military and government bureaus.

PROPERTIES OF EXTRUDED ALLOYS—TABLE IX

AUSTENITIC STAINLESS STEEL EXTRUDED BAR PROPERTIES

Type	Condition	Direction	0.2% Yield Strength, psi	Tensile Strength, psi	Elong. % in 2 in.	Reduction in Area, %	Hardness Rockwell B
304	As Extruded	L	27 600	80 700	57	76.4	81
		T	27 500	76 700	60	66.6	77
310	As Extruded	L	24 100	66 000	54	70.0	74
		T	27 000	70 300	57	64.5	76
316	As Extruded	L	25 000	65 200	68	91.0	69
		T	28 100	68 900	68	75.3	72
321	As Extruded	L	21 000	67 200	63	75.1	74
		T	27 000	65 000	69	75.2	74
347	As Extruded	L	28 000	73 400	74	77.2	76
		T	29 400	77 600	70	68.8	76

MARTENSITIC STAINLESS STEEL EXTRUDED BAR PROPERTIES*

410	As Extruded	L	83 300	101 000	25	69.5	20
			84 100	101 600	23	61.6	21
410	Heat Treated 1750F-1-Oil 1000-2-Air	L	132 600	150 500	20	66.1	44
		T	134 500	158 200	15	52.5	45
418 Sp.	Annealed 1450F-2-Air	L	120 000	147 700	18	54.2	—
		T	123 000	147 500	18	45.4	—
	Heat Treated 1800-F-Air 700-2-Air	L	177 700	205 800	20	45.8	—
		T	169 200	203 200	13	34.6	—
431	Heat Treated 1750F-½-Air + 1250-2 Air	L	103 500	125 500	21	58.5	—
	Heat Treated 1800F-½-Air + 550-2-Air	L	158 400	206 300	15	27.0	—

CARBON AND ALLOY STEEL EXTRUDED PROPERTIES**

1020	As Extruded	L	35 600	59 700	35	58.8	Rb. 68
		T	21 000	59 300	34	55.0	68
4130	Normalized 1650F-1 hr-Air	L	84 600	116 000	24	56.4	92
		T	82 000	111 000	21	54.1	92
	Heat Treated 1575F-1 hr-Oil +850-2 hrs-Air	L	157 600	164 900	16	57.7	Rc. 27
		T	154 000	159 200	12	50.0	Rc. 27
4340	Annealed 1500F-1 hr-Fc	L	103 900	164 700	13	35.7	Rc. 29
		T	106 900	167 900	12	32	Rc. 30
	Heat Treated 1525F-1 hr-Oil+ 850-2 hrs-Air	L	163 000	176 000	17	50.0	Rc. 36
		T	165 000	178 000	12	34.0	Rc. 37
8630	Annealed 1575F-1 hr-FC	L	42 520	79 000	33	65.1	Rb. 77
		T	52 000	74 300	28	54.1	Rb. 81
	Heat Treated 1600F-1 hr-Oil+ 500-2 hrs-Air	L	168 000	187 000	7	36.8	Rc. 32
		T	183 200	199 200	7	27.6	Rc. 33

*NOTE: Tests on 431 were determined on standard .505" specimens from a 1" round extruded bar. All others were determined on .252" diameter specimens taken from a 3⅛" x ¾" extruded bar. L-Longitudinal Direction. T-Transverse Direction.

**NOTE: Tests were run on .252" diameter specimens taken from a 3⅛" x ¾" extruded rectangular bar. L-Longitudinal Direction. T-Transverse Direction.

Designing for Steel Extrusions

By J. J. BARRETT*

EXTRUSION, the precision metal working process which literally molds metals under pressure into tubular or solid shapes, is coming to the fore to meet the demands of today's space age, the nuclear age, and the almost forgotten old-fashioned industrial age.

As more and more design engineers adopt this growing production technique, extrusions of ferrous base metals are finding their way into cost-saving applications ranging from jet engine parts to the practical, everyday variety of door jambs (Figure 1).

Today, thanks to continued research and development, alloys once considered too difficult or impossible to work can now be extruded to meet industry requirements for metals with improved high temperature strength, and oxidation and corrosion resistance.

TABLE I

Some metals and alloys which have been extruded.

AISI 1020	B&W 15-15-N
AISI 4135	Timken 16-25-6
AISI 4140	Discaloy
AISI 52100	Refractaloy 26
AISI 410	K42B
AISI 420	19-9-DL
AISI 430	AISI 330
AISI 431	Nodular Iron
AISI 440C	Rex AA
Croloy 20-A	Peerless A
AISI 443	Rex VM
AISI 446	Cyclops B4B
AISI 329	Monel
17-4 PH	"A" Nickel
AISI 304	Nimonic 80
AISI 309	AISI 201
AISI 309Cb	AISI 347
AISI 310	AISI 348
AISI 310 Cb	AISI 416
AISI 316	AISI 4340
AISI 316 Cb	Titanium-Commercially Pure
AISI 317	
AISI 317 Cb	Titanium Alloys
AISI 321	Zirconium

WHERE TO USE EXTRUSIONS

Today's design engineer can most economically specify extrusions if any of the following conditions exist:

- Desired section configurations, either for structural or aesthetic reasons, are difficult or impossible to produce by other methods (Figure 2).
- Where two or more adjacent sections of an integral complex shape must now be fastened by welding or mechanical means (Figure 3).
- Where running design changes are anticipated or desirable. The low cost die design charge, the short lead time, and the ability to produce in small quantities allow for frequent design changes without excessive cost.
- Where shop spoilage is a problem. Make-up delivery is possible in a matter of days with extrusions.
- Where equipment for special machining is not available, or where special contours are necessary or desirable (Figure 4).
- Where roll costs are too high to be absorbed in low volume production.

EXTRUSION AVAILABILITY

Generally speaking, The Babcock & Wilcox Co. can furnish steel extrusions as small as .50 square inch cross-sectional area up to anything that can be contained in a 6½-inch circle. The grade of steel desired, the section thickness, ratio of cross-sectional area to width of section as well as length of section, and the general section configuration – all have a bearing on these size limitations (Figure 5).

The surface finish, dimensional control, and mechanical properties of extruded steel sections are generally equal to those of hot rolled products of the same material.

Practically all of the standard AISI stainless steel grades are available plus many special grades as well as the SAE alloys and carbon steel (Table I).

HOW TO SAVE WITH EXTRUSIONS

A few guidelines will help the design engineer to determine the most economical application of extrusions to his own particular specialty:

1. Adjacent section thicknesses should be as nearly equal as possible to permit uniform metal flow through

*THE BABCOCK & WILCOX CO. TUBULAR PRODUCTS DIV.

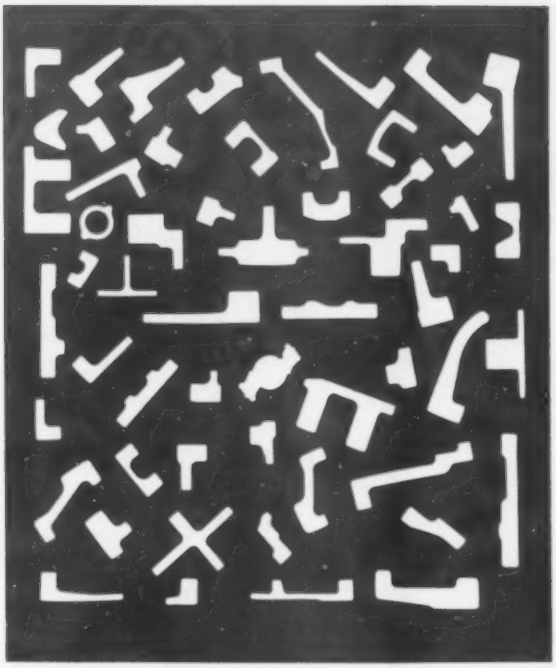


FIGURE 1. Extruded shapes range from jet parts to door jambs.

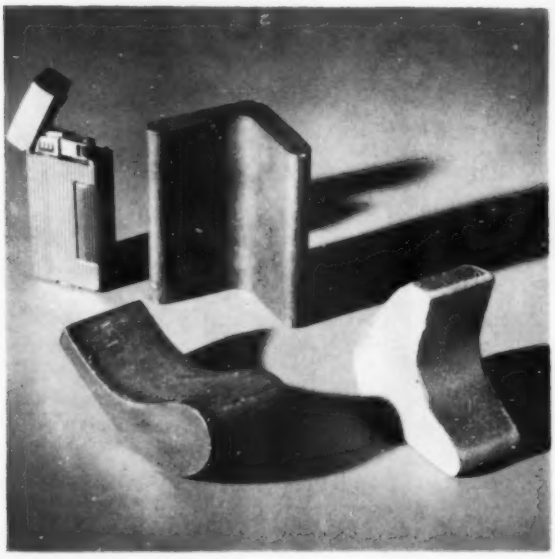


FIGURE 2. Use extrusions for shapes hard to make other ways.

FIGURE 3. One extrusion may replace several joined sections.

FIGURE 4. Special, non-machinable contours may be extruded.

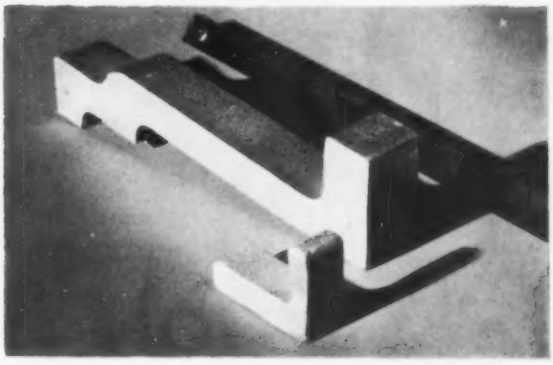


FIGURE 5. A wide variety of sizes and grades is available.

the die. Four-to-one approaches the desired thickness ratio limit.

2. Grooves should be wide and shallow to prevent undue pressure and heat on the portion of the die forming the groove (Figure 1).

3. Corner radii should be from .093″ to .125″ depending on grade so that corners may fill properly.

4. Fillets should have a radius of approximately .250″ where included angle is 90° or greater to insure maintenance of fillet dimensions.

The jet engine is an example of the savings accomplished by the use of extrusions. Prior to the availability of an extruded steel product, sections used for these rings were made either from solid rectangular bar or rolled irregular sections. The extrusion process made possible a considerable saving in material over the solid rectangular bar and allowed greater flexibility in design change over the use of rolled, irregular sections.

A list of some of the metals and alloys which have been successfully extruded is given in Table 1. If a particular alloy does not appear on this list, it does not necessarily follow that it cannot be extruded; chances are that it can.

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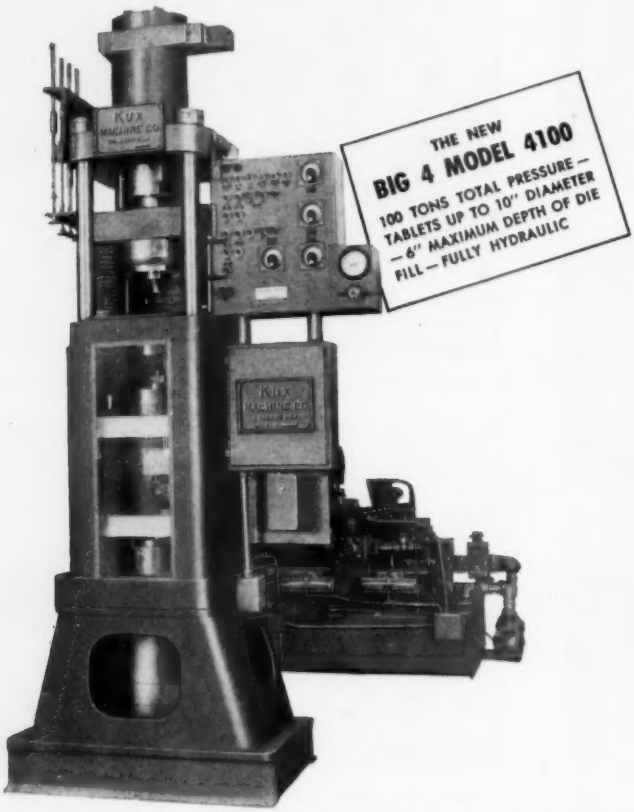
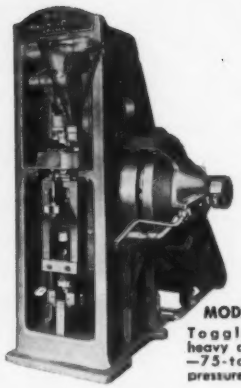
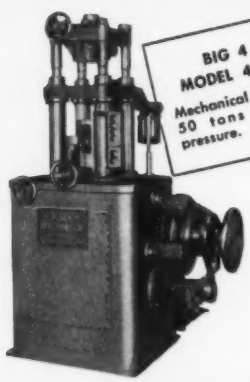
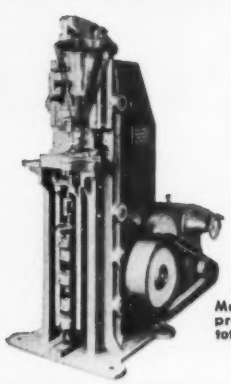


- **Fully Hydraulic** — applies pressure to tablet with both upper and lower punches. Lower punch ejects tablet with full forming pressure.
- **Completely Automatic** — pushbuttons operate machine continuously or through a single cycle with an automatic stop position.
- **Accurate Dimensional Thickness of Tablets** — upper and lower punches come to a positive mechanical stop position, holding thickness of each tablet.
- **Always True Density** — upper and lower punches can be adjusted to come to a hydraulic pressure stop position, applying exact pressure on the tablet to give true density regardless of variation in die fill.
- **Perfect Punch and Die Alignment** — combination leader-pin, ball-bearing guides keep upper punch in perfect alignment with die at all times, so that close tolerance parts can accurately be made.
- **Push Button Control of Adjustments** — for upper punch penetration into die, and the die fill allows instant and accurate change of either setting, and scales show the exact position of the punches at all times.
- **Independent Secondary Lower Punch Mechanism Available** — hydraulically operated with separate timing and stroke control — can be used to apply pressure, to eject compact, or to move core rod up and down during filling or ejection sequence.



MODEL 65B
Toggle type heavy duty press —75-ton total pressure.





MODEL 64
Multiple motion press — 30 tons total pressure.

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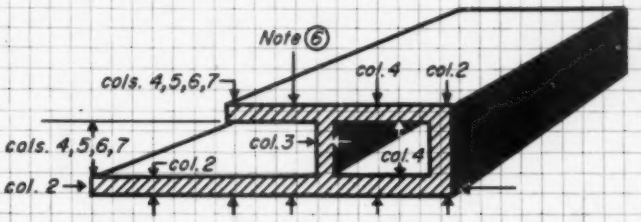
EXTRUSIONS

Standard Tolerances① Extruded shapes.....

use these PMM **Design Tips** for lower costs -better products



Specified dimension (inches)	TOLERANCE ② ③ – INCHES PLUS AND MINUS					
	METAL DIMENSIONS		SPACE DIMENSIONS			
	Allowable deviation from specified dimension where 75 per cent or more of the dimension is metal		Allowable deviation from specicified dimension where more than 25 per cent of the dimension is space ⑥ ⑦			
	All except those covered by column 3	Wall thickness ④ completly ⑤ enclosing space .11 sq in and over (eccentricity)	At dimen-sioned points .250-.624 inch from base of leg	At dimen-sioned points .625-1.249 inches from base of leg	At dimen-sioned points 1.250-2.499 inches from base of leg	At dimen-sioned points 2.500 inches or more from base of leg
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
Up thru 0.124	.006		.010	.012	.014	.016
0.125-0.249	.007		.012	.014	.016	.020
0.250-0.499	.008	Plus and minus 10% of specified dimension; ± .060 max. ± .010 min.	.014	.016	.018	.022
0.500-0.749	.009		.016	.018	.020	.026
0.750-0.999	.010		.018	.020	.022	.030
1.000-1.499	.012		.020	.022	.026	.034
1.500-1.999	.016		.024	.028	.034	.050
2.000-3.999	.024		.032	.036	.048	.064
4.000-5.999	.034		.042	.050	.064	.088
6.000-7.999	.044		.054	.062	.082	.112
8.000-9.999	.054		.064	.074	.100	.136
10.000-11.999	.064		.074	.088	.116	.160
12.000-13.999	.074		.084	.100	.134	.184
14.000-15.000	.080		.090	.106	.142	.196

① These Standard Tolerances are applicable to the average shape: wider tolerances may be required for some shapes and closer tolerances may be possible for others.

② The tolerance applicable to a dimension composed of two or more component dimensions is the sum of the tolerances of the component dimensions if all of the component dimensions are indicated.

③ When a dimension tolerance is specified other than as an equal bilateral tolerance, the value of the Standard Tolerance is that which would apply to the mean of the maximum and minimum dimensions permissible under the tolerance.

④ Where dimensions specified are outside and inside, rather than wall thickness itself, the allowable deviation (eccentricity) is ± 10% of mean wall thickness; ± .060 inch maximum, ± .010 inch minimum. (Mean wall thickness is the average of two wall thickness measurements taken at opposite sides of the void).

⑤ In the case of Class I Hollow Shapes the standard wall thickness tolerance for extruded round tube applies.

⑥ At points less than .250 inch from base of leg the tolerances in column 2 are applicable.

⑦ Where the space is completely enclosed (hollow shapes) the tolerance for the width is the value in column 4 for a dimension equal to the depth, and conversely, but in no case is the tolerance less than at the corners (Col 2) Example: The width tolerance of a hollow shape having 1x3 inch rectangular outside dimensions is ± .024 inch, and the depth tolerance is ± .032 inch. Tolerance at the corners (Col 2) is ± .024 inch for the width and ± .012 inch for the depth.

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How B&W JOB-MATCHED EXTRUSIONS can reduce the cost of your finished product

Machining is expensive and wastes material. It is doubly so when it is not necessary. Design engineers should investigate the possibility of using an extruded section as starting material, particularly if expensive or difficult to machine materials such as alloy or stainless steels are involved. In many cases, by using a B&W Extrusion, parts production can be reduced to a mere cutting to length and a few simple finishing operations.

To find out more about how B&W Extrusions can help you design a better product at a lower cost call on any of the local sales offices of B&W's Tubular Products Division or write for a copy of Bulletin TB 413. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pennsylvania.

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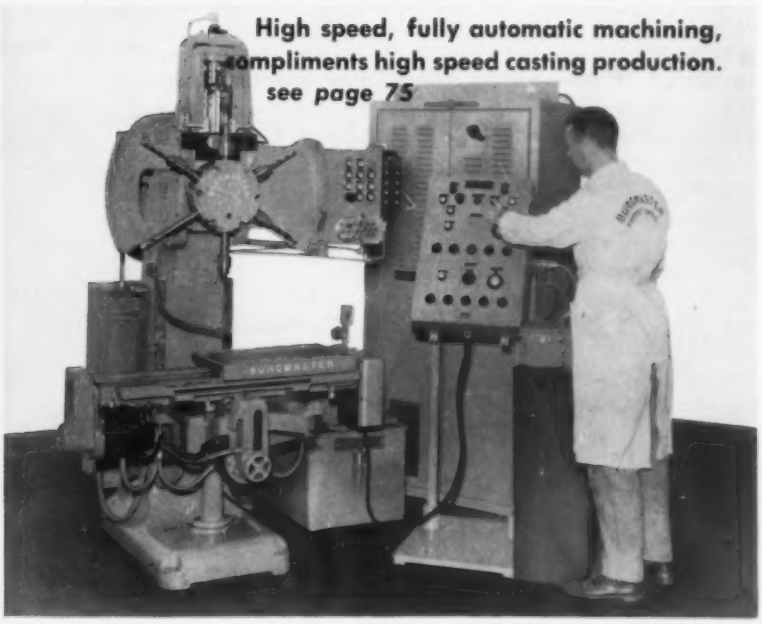
Finishing Section

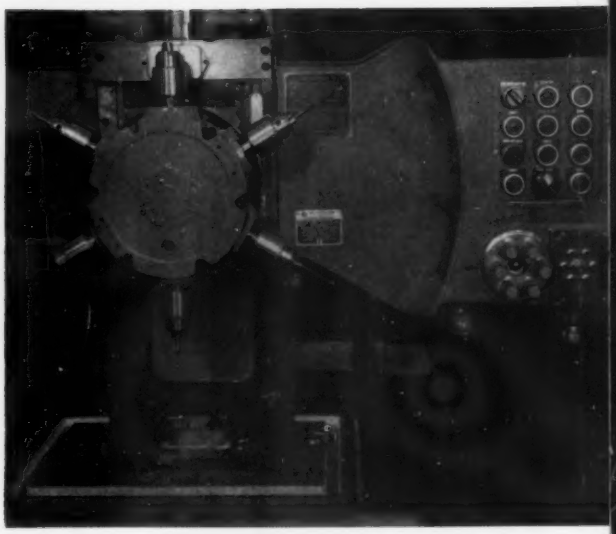
The specialized finishing methods, equipment and materials used to machine, assemble, surface condition or surface coat precision metal molded parts are presented here. This includes all secondary operations which convert a raw casting to a finished product.



High speed, fully automatic machining, compliments high speed casting production.
see *page 75*

Take advantage of modern methods; use . . .

Numerical Tape Controlled Machining



MASS PRODUCTION has been responsible for the phenomenal growth of the die casting and permanent mold casting industries. Where parts can be produced by these methods substantial savings are frequently shown. Not only is basic production very fast, in many cases the casting is so nearly complete, as cast and trimmed, that only minor operations need to be done to finish it.

With modern numerical tape control applied to multi-purpose machines, finishing operations can be speeded up to match the economies of the casting operation.

As an example, consider the application of General Electric's numerical tape control applied to a Burgmaster 6 or 8 spindle turret drilling, tapping and boring machine. What are the advantages?

Either short or long production runs of parts can be machined on the fully automated machines. Setup of parts is extremely fast, only simple holding clamps are needed. Standard tooling is used. Other advantages are:

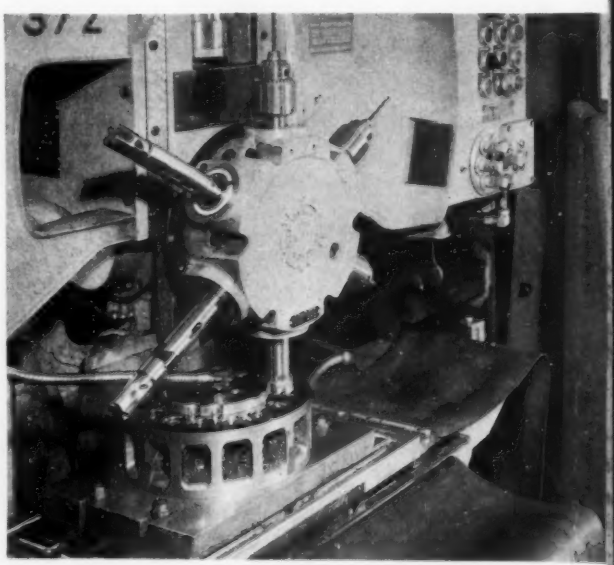
1. Greatly reduced lead time to get into production.
2. Simplified tooling – expensive fixtures are eliminated. Drill bushings are not needed.
3. Punched tapes are quickly corrected, expensive tool rework is eliminated.
4. Only semi-skilled labor is required.
5. Fewer rejects due to lack of operator skill.
6. Greater accuracy – hole location controlled to ±0.001", repeatable to ±0.0005".
7. Tool feeds and speeds are pre-selected for greatest efficiency, result, longer tool life.
8. Simple to program and tape parts – use a Flexowriter Typewriter.
9. Inspection load reduced.
10. One operator can run two or more machines.

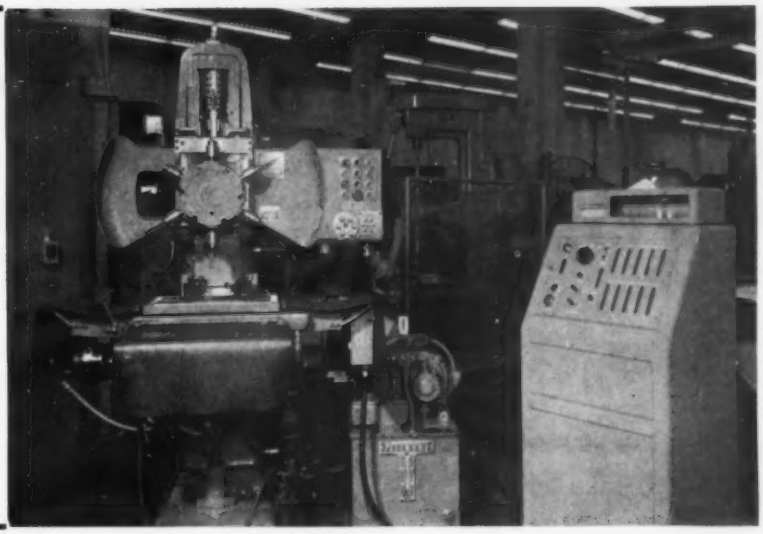
The tape control system automatically positions the machine table on two axes and operates the hydraulic controls on the turret drill to carry out a predetermined cycle of operations. The operations may include drilling, boring, tapping, reaming, counterboring, and spot facing. Simple, standard tools are used for all of these operations. The tape controls all of the machine functions, positions the table, indexes the turret in any sequence, clamps the table in position while machining operations are being done and can control any desired auxiliary functions. Some of the extra functions that are controllable with the tape are turning coolant off and on, chip blowing, etc.

Programing is simple and once a program sheet has been established it is a simple matter for a typist to prepare the tape. Speeds and feeds are preset on the machine and are not controlled by the tape.

The use of tape control does not alter either manual or dial control when it is desired to use them, it simply adds another dimension to the machine.

Since only simple holding fixtures are needed, there is no problem of jig, fixture, and special tooling storage between runs. The tape is filed in an ordinary card file. Whenever a repeat run is required the tape





GEAR HOUSING requires six different operations. By using tape controlled six-spindle turret drill (closeup at left), part was programmed in 1½ hours and hand-punched, reusable tape prepared in 15 minutes. This part formerly was produced on six single-spindle table-type drill presses.

is put into the machine, feeds and speeds set and the machine is ready to go to work again. The only basic requirement is that the locating point, or zero location be accurately set.

Typical of the saving in machining of castings that are possible through the use of numerical tape control on machine tools are these two cases.

I—CAST INSTRUMENT GEAR HOUSING

Six operations were necessary; center drilling, drilling, reaming, and boring 5 different diameters. Twelve holes involved. There was 50% less machining time and 50% less tooling cost. Lead time cut in half. The twelve holes were machined in 3½ minutes, floor to floor, location held within 0.002″.

II—CAST VALVE PART

One man operates two tape controlled machines. Machining time cut from 96 minutes to 26 minutes each, a 75% saving.

The parts are produced in lots of 50 to 200 and formerly required special fixtures which cost approximately $500.00 each, all drill bushings were eliminated. The punched tape was made in three hours and can be stored and reused indefinitely. Control on all machining operations is held within the 0.0025 tolerances required between holes. An added bonus, the operator now has time to inspect the finished castings.

In addition to the advantages outlined, numerical tape control assures a higher degree of reproducibility from run to run than is possible when the machines are manually operated. Even with precise, and expensive, fixtures there can be more deviation than is possible when tape control is used.

With only reasonable care, the mylar plastic tapes will last indefinitely. They are easily and quickly punched with a hand punch, or the machine may be equipped with a 1″ wide tape to allow punching on a Flexowriter.

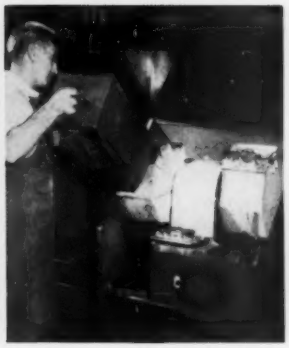
VALVE PART (see closeup at left) is now machined on tape controlled turret drill in 26 minutes, compared with 96 minutes on radial drill presses with special fixtures and guide bushings. Also, one man runs two machines and, in addition, has time to inspect parts, further reducing cost.

REPORT FROM WESTCLOX • *Division of General Time Corporation*

"Here's how we save $46,464 annually by deburring clock parts with ALMCO BARREL FINISHING EQUIPMENT."

"MY NAME IS A. R. BIERBRODT. Here at La Salle, Illinois, I'm Supt. of Metal Finishing for the Westclox Division of General Time Corporation, makers of the famous Big Ben alarm clocks. I'd like to show you how we save big money by using ALMCO barrel finishing machines for deburring and finishing 24 different clock parts in our plant."

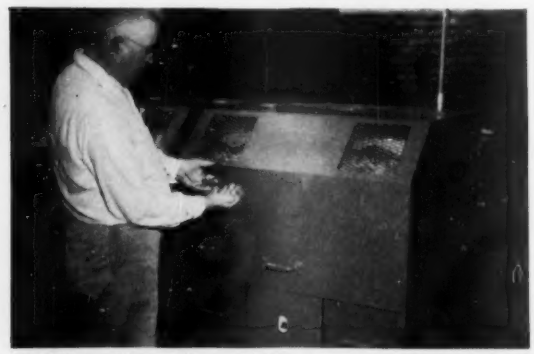
(1) "Here, John Chambers lifts the hood of one of our 10 ALMCO machines. We figure we save $46,464 annually by deburring and finishing clock parts with ALMCO barrel finishing equipment."



(2) "Parts to be finished are added to predetermined proportions of media and compounds. A total of 10,000 cast gear wheels, for example, can be deburred and finished in one hour's time."

(3) "Lock 'er up and we're ready to go. Previously, when these clock parts were deburred and finished with power tools, only 3,500 parts were finished during an 8-hour work period."

(4) "A flip of the switch and the precision process begins. Burrs are removed, rough edges smoothed to specifications, and 80,000 perfectly finished parts delivered to production lines each day."



(5) "Here, Harry House, Foreman, inspects clock parts finished by ALMCO Supersheen equipment and methods. Barrel finishing has given us a daily labor saving of $193. What's more, quality and uniformity are good and production is way up. Results are truly outstanding."

LEARN HOW MODERN BARREL FINISHING can improve your product! The facilities of ALMCO's new technician-staffed lab in Albert Lea, Minnesota, are available to you without obligation. Send your sample parts with specifications desired or write on your company letterhead requesting an ALMCO engineer to visit your plant.

SEND FOR YOUR FREE barrel finishing handbook. 52 pages of case history facts and barrel finishing processes. Illustrated equipment section. Includes detailed cost chart on finishing of typical parts. Send for your free copy today!

ALMCO

Queen Products Division / King-Seeley Corporation
75 E. Main St. • Albert Lea, Minnesota

Sales Engineering Offices in Chicago, Detroit, Los Angeles, Newark, New Haven and Philadelphia.

IN ENGLAND: *Almco Division of Great Britain, Ltd., Hitchin, Herts, England.*

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continued from page 28

INDUCTOTHERM NAMES SUNDEEN

SUNDEEN

Robert W. Sundeen has joined the sales engineering staff of INDUCTOTHERM CORP. He formerly was with the Allen-Bradley Co.

COMPETITION OPEN FOR METAL POWDER DESIGNS

THE NEW JERSEY ZINC CO., publisher of METAL POWDER PRESS, is sponsoring an awards competition for the best application of brass or nickel silver powder metallurgy for mechanical or structural parts in product design. Cash prizes will be awarded the best qualifying entries in the contest.

The competition is expected to stimulate interest in imaginative and progressive use of nonferrous powder metallurgy. Any product, assembly, or component using a structural or mechanical part made of brass or nickel silver powder is eligible, provided the part is, or soon will be, in production.

Judges are: Philip R. Kalischer, editor, PRECISION METAL MOLDING; Henry R. Clauser, editor, MATERIALS IN DESIGN ENGINEERING; and Elmer J. Tangerman, editor, PRODUCT ENGINEERING.

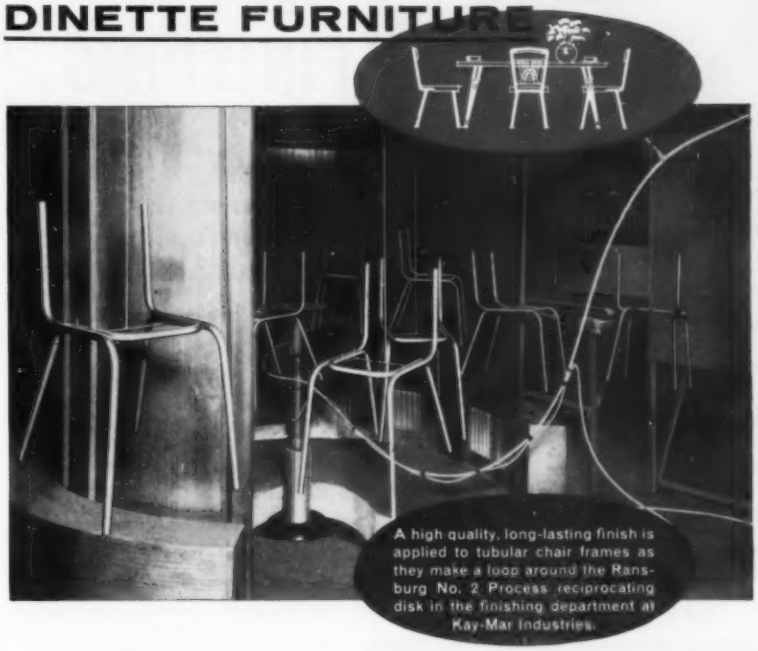
Deadline for entries is midnight, June 30. Entry blanks and complete details are available from Metal Powder Awards Editor, The New Jersey Zinc Co., 160 Front St., New York 38, N. Y.

HITCHINER ACQUIRES PERMATTACH DIAMOND

HITCHINER MFG. CO., INC., has acquired all assets of the PERMATTACH DIAMOND TOOL CO., INC.

RANSBURG *Electro-Spray...*

PROVIDES 50% PAINT SAVING (over the former dip method) in the finishing of KAY-MAR DINETTE FURNITURE



A high quality, long-lasting finish is applied to tubular chair frames as they make a loop around the Ransburg No. 2 Process reciprocating disk in the finishing department at Kay-Mar Industries.

● Kay-Mar Industries, Cassopolis, Michigan, switched from the dip method to Ransburg Electrostatic Spray Painting because they wanted to improve the quality of the finish on their metal furniture line.

Now, with electrostatic spray painting, they get a heavier, more uniform application, which was not possible with former dip. With electrostatic, they are able to use metallic coatings with higher metal content. In their magazine advertising to the mobile home industry, they proudly say: "Finest finish in the industry at no additional cost to you!"

Electrostatic provides other advantages at Kay-Mar. They picked up some additional—and much needed—floor space when dip tanks were removed. Their insurance rates were reduced because of improved "housekeeping" conditions. Frequent color changes are made quickly and simply, and rejects—which used to run 1½%—are reduced to less than a quarter of one per cent.

NO REASON WHY YOU CAN'T DO IT, TOO!

Let us test prove the advantages of automatic electrostatic spray painting on your products in our complete laboratories. No obligation. Call or write for our No. 2 Process brochure, which shows a variety of automatic painting installations on a wide variety of products. Or, if your production doesn't justify automatic painting, let us tell you about the new Ransburg No. 2 Process electrostatic hand gun, now widely used by both large and small manufacturers.

RANSBURG

RANSBURG
Electro-Coating Corp.
Box-23122, Indianapolis 23, Indiana

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consult the.... Roto-Finish

CUSTOMER'S MAN

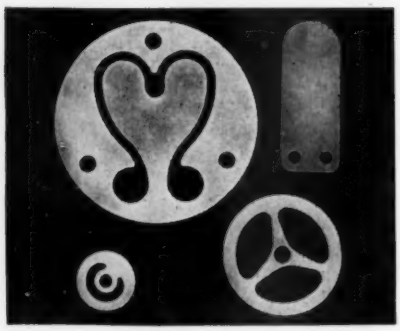
FOR
FINISHING
PLUS+

RESEARCH AND TECHNICAL ASSISTANCE

Faced with the problem of cutting down finishing costs with no sacrifice in product quality, more and more production and management men are turning to Roto-Finish for complete finishing *service*.

In the Roto-Finish Laboratory, technicians analyze your problem to determine the process which provides the desired finish at minimum cost. Often, it is necessary *to develop a new compound* to meet a specific need.

Test runs are then made in the Roto-Finish Processing Department under production conditions. If desired, your local Roto-Finish Customer's Man will run these tests in your own plant; so that you can check the results at first hand, results like this...



Roto-Finish CASE HISTORY

PART: Refrigeration compressor flapper valves. • MATERIAL: Swedish steel. OPERATIONS PERFORMED: Deburr. Generate full radii on all edges. Remove stress risers. • RESULT: Fatigue resistance increased 500%.

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KAISER UPS O'HALLORAN

O'HALLORAN

M. J. O'Halloran has been promoted to assistant general sales manager, industrial product sales, for KAISER ALUMINUM & CHEMICAL SALES, INC. Formerly marketing manager of rod, bar, and wire products, he succeeds S. P. Whiteside, who was named northeastern regional sales manager.

McELWAIN IS SALES REP FOR ALAN WOOD STEEL

Keith M. McElwain has joined ALAN WOOD STEEL CO. as iron powder technical sales representative for the eastern district. He formerly was sales engineer and metallurgist for The Bassick Co.'s Powder Metal Dept.

PRECISION MFG. GETS DUCTILE IRON LICENSE

PRECISION MFG. CO. has been granted a license by the INTERNATIONAL NICKEL CO. to produce castings of Ductile Iron.

OAKITE REPS MEET

OAKITE PRODUCTS, INC., held a regional sales conference for 45 technical service representatives who cover New England, upstate New York, and Metropolitan New York. The conference, third in a series of five regional meetings, gave the men a chance to compare notes on developments in the field, and to share experiences to improve customer service.

BAROID NAMES MIERICKE

BAROID CHEMICALS, INC., has appointed Kurt A. Miericke technical representative to foundries. He'll continue to maintain his office in the McCormick Bldg. in Chicago.

REMINGTON JOINS MPI

REMINGTON ARMS CO., INC., and SOCIETE UGINE-CARBONE have been elected to membership in the AMERICAN POWDER METALLURGY INSTITUTE. Remington Arms fabricates powder metallurgy parts used in Remington firearms and other products. Ugine-Carbone is one of France's leading manufacturers of powder metallurgy parts, cemented carbides, heavy metals, and self-lubricating bearings.

CRUCIBLE STEEL PROMOTES TWO

Drs. James K. Stanley and James A. Stavrolakis have been named section managers in technical development at CRUCIBLE STEEL CO. OF AMERICA. They will coordinate process and product development on two product lines. Stanley formerly was supervisor of the silicon steel, magnetic materials, and applied physics sections; Stavrolakis was research coordinator.

MATE JOINS NATL. TOOL

Julius Mate has been named NATIONAL TOOL & MFG. CO. sales representative for western Ohio, western Pennsylvania, and New York. Mate formerly was with Detroit Engineering Co.

CAPITOL PRODUCTS MOVES TOWARD INTEGRATION

In a step toward increased efficiency of operation, CAPITOL PRODUCTS CORP., has appointed George R. Metzdorf vice president in charge of manufacturing.

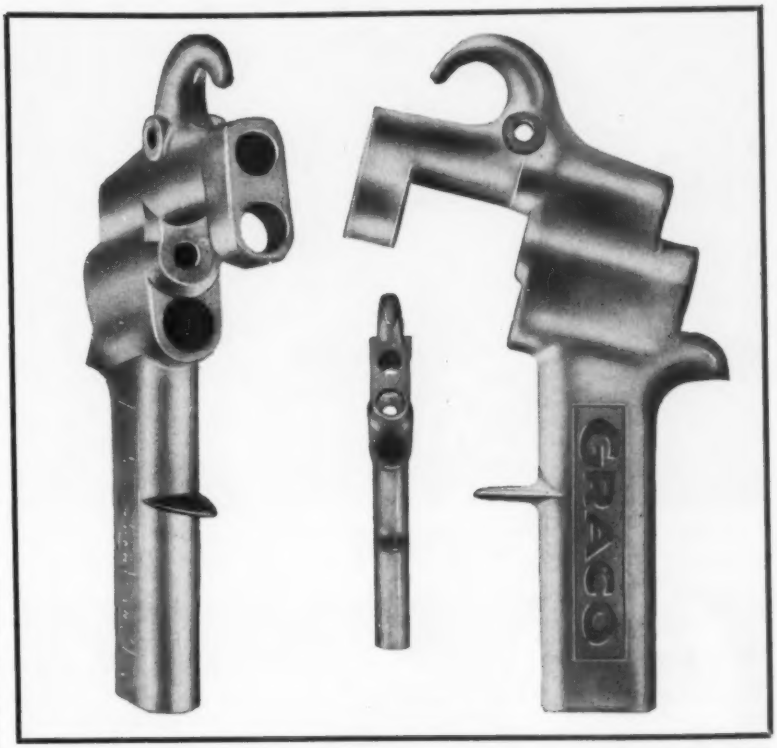
Mr. Metzdorf will be responsible for all manufacturing and manufacturing services throughout the country, including the Read Standard Div. of the company.

HAMPDEN BRASS EXPANDS ITS FACILITIES

The addition of two new 1000 ton die casting machines to their present 400 and 500 ton machines has greatly expanded the die casting facilities of the HAMPDEN BRASS & ALUMINUM CO.

Each of the new machines is capable of injecting 25 lbs. of aluminum and 60 lbs. of zinc. The machines have a casting capacity of 900 sq. in. of aluminum.

The new machines will enable the company to make non-ferrous castings of any size.



here's how Die Casting adds form to function

Die casting doesn't stop at producing parts that perform. Die casting adds eye appeal, allows engineers to design for *sales* as well as for *function*.

Take this Gray Company spray gun handle. Note how design has reduced subsequent machining; cast in nine holes, three with double diameters; created an integral unit around which the complete tool can be assembled. Note, too, the balance and eye appeal. This is the kind of machine a body man *likes* to hold in his hand, wants to have in his shop.

Good design is never an accident. But the secret of good design is often a knowledge of parts production that makes good design possible. That's where die casting comes in. With die casting your engineers design for form as well as function.

If your product must deliver sales appeal and performance, call Twin City Die Casting. Twin City engineers can probably help you get *more* from the die casting process . . . not because they know your job, but because they know die casting so well.

...only DIE CASTING can

✔ cut your costs ✔ offer such flexibility ✔ provide such accuracy

Leading Die Casters in the Upper Midwest

TWIN CITY DIE CASTINGS CO.

3351 TALMADGE AVE. S. E. • MINNEAPOLIS 14, MINN. • PHONE MI 6-7528

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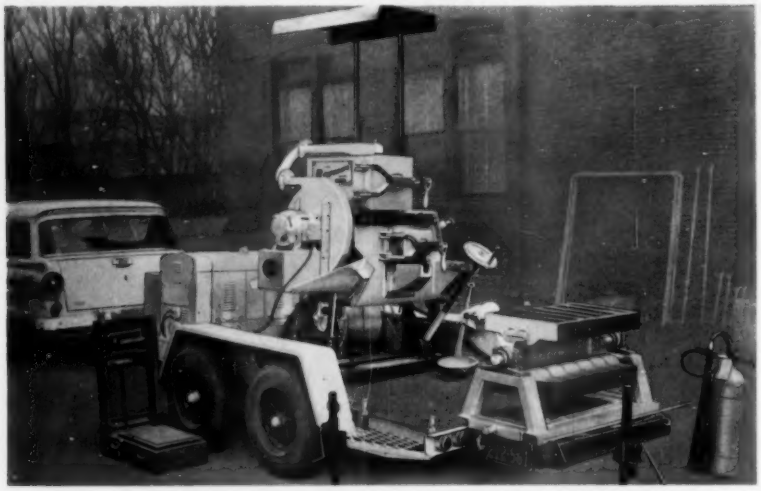
TRAVELING FURNACE ON NATIONWIDE TOUR



INTERNATIONAL FOUNDRY SUPPLY CO. is sending a mobile demonstration unit to visit foundries in every state to demonstrate the Revecon furnace. The unit is staffed by an engineer and foundry technician who work with the metal used by the foundry being visited.

These in-plant demonstrations enable the foundry workers to observe the new melting techniques which can save a foundry more than 50% of present melting costs.

NOTRE DAME TO HOLD SINTERING CONFERENCE

UNIVERSITY OF NOTRE DAME'S Dept. of Metallurgy will conduct a conference on sintering and related phenomena June 15-17. The conference is being held to bring together the chemists, engineers, and physicists interested in sintering, thereby facilitating the exchange of ideas and experience of various research groups.

Papers to be presented will cover diffusion, plastic and viscous flow, creep, surface physics, crystal growth, and other phenomena.

ALUMINUM EXTRUDERS REPORT PROGRESS

At the spring conference of the ALUMINUM EXTRUDERS COUNCIL, held in March at the Hotel Algiers, Miami Beach, these reports highlighted the meeting:

- Enough members have expressed an interest in the August Kitimat conference to warrant immediate planning. Aluminum Co. of Canada will be host at the meeting, which will be held during the week of August 10.
- Standards committee reported that work is progressing on die lubricants, safety features, interlocks for extrusion presses, mandrel-type aluminum presses, ejector and dummy block design and clearances, and a metallurgical evaluation of various elements within the range of 6063.
- Operating ratio committee has reviewed the previous study made in 1955 and 1956. With certain modifications and additions, the study will be continued for 1957 and 1958.
- A two-day technical meeting has been scheduled for Pittsburgh June 11-12. In addition to technical discussions, the meeting will include a tour of the research and development laboratories at Alcoa and Latrobe Steel Co.

GRIND
POLISH
BUFF
DEBURR

WITH A Hammond STRAIT LINE AUTOMATIC

Over and Under Strait-Line shown. Other Strait-Lines available in Reversing, Horizontal Return and Open Center types.

Head styles include floating, non-floating and oscillating with 1-1/2 to 25 HP range.

Hammond Automatics will speed your grinding, polishing, buffing, brushing and deburring operations.

Send Samples . . .
and we'll show you how much you can speed production and cut costs.

Hammond Machinery Builders INC.

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See us at the Industrial Finishing Exposition — June 15-19 — Detroit — Booths 261-266
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METAL FINISHING PROCESSES

A complete line of quality products and processes developed primarily as a result of helping manufacturers like yourself solve their metal finishing problems. If one of our present products does not meet your needs, we'll be glad to work with you to find an answer to your problem.

IRIDITE® Chromate Conversion Coatings for Non-Ferrous Metals.

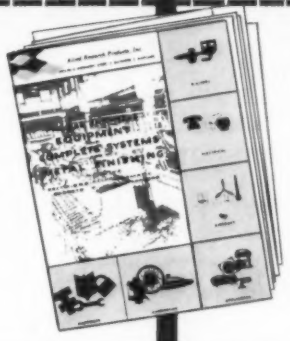
IRILAC™ Clear Protective Coatings for All Metals.

ISOBRITE® Chemically Different Plating Brighteners.

ARP® Process chemicals.

EQUIPMENT AND COMPLETE SYSTEMS for Metal Finishing

Process Engineered—Single pieces of equipment or all equipment necessary for a finishing operation—evaluated, designed, fabricated, installed and tested to match exactly your particular process. Ask about our *Process Engineering Service.*



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Silicon and Selenium, built to exacting specifications for long life, trouble-free service.

WAGNER AUTO-LOADERS

for fast, economical transfer of racks and parts, conveyors to plating machines, between conveyors.

AUTOMATIC AND SEMI-AUTOMATIC PLATING MACHINES

BARRELS, TANKS and other equipment.

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Prompt service on a wide variety of daily-use necessities for the plating room, delivered from warehouse stocks strategically located in cities in metalworking areas.

FLAT-TOP® **ANODES** in copper and zinc.

LECTROCOP® **FLAT COPPER ANODES**

CADMIUM, WHITE BRASS AND TIN ANODES in most efficient shapes. Acid Replacements, Buffs, Chemicals, Cleaners, Maintenance Materials.

NICKEL RECASTING SERVICE

Ask your Allied Field Engineer about our Subscription Plan which combines your new nickel purchases with a service to recast *your* butts and spears, resulting in substantial savings.

Allied Research Products, Inc.

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Chemical and Electrochemical Processes, Anodes, Rectifiers, Equipment and Supplies for Metal Finishing.

WRITE TODAY FOR COPIES of these useful files describing technical details of our complete line, OR, phone your Allied Field Engineer. He's listed under "Plating Supplies" in your 'phone book.

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ULTRASONIC BREAKTHROUGH!

ONLY ACOUSTICA ULTRASONIC CLEANERS HAVE MULTIPOWER!

The Multipower transducer developed by Acoustica research, multiplies the power and efficiency of ultrasonic action. Cleaning is faster, better, labor costs are lower. Acoustica ultrasonic cleaners are built for performance and durability. They are engineered to the finest standards, unequaled in quality and value.

Off-the-shelf in capacities from 1 to 75 gal. or custom built to 5000 gal. and more. Expert Acoustica engineers can help you with your cleaning problems. Send for further information.

acoustica

LEADER IN RESEARCH & DEVELOPMENT OF ULTRASONIC SYSTEMS

Los Angeles and New York

Acoustica Associates, Inc.
Dept. PM, 26 Windsor Ave., Mineola, N. Y.
Send information describing advantages of Acoustica ultrasonic cleaners.

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Company_____

Address_____

City_____ Zone____ State_____

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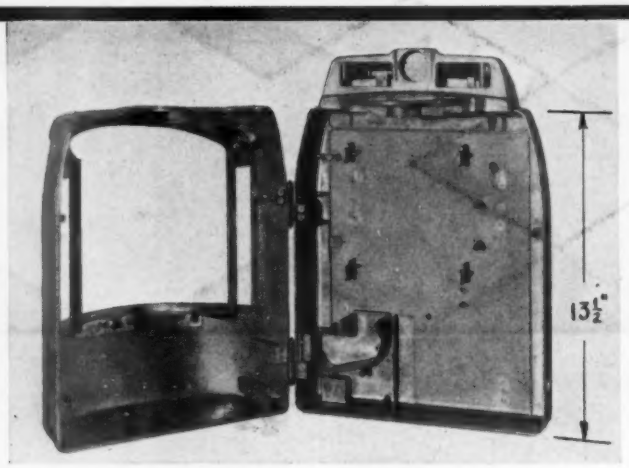

WHY DIE CASTINGS?

Highly developed die casting techniques combined with water hydraulic impact injection produces castings for exterior parts. The combination of aluminum and zinc castings on assemblies is feasible as they can be finished the same.

Federal

DIE CASTING COMPANY

2220 NO. ELSTON AVE. CHICAGO 14, ILL.

Phone AR-6-4003

Remet Powdered Metal Part cuts DESIGN and MACHINING costs for Bonney Forge and Tool Works

R. L. Huston, Chief Engineer for Bonney, says, "We went to a powdered metal part on our shifter because the cost of machining this part from steel would have been prohibitive. Also, we would have had to change the entire design of our ratchet. We contacted no less than a dozen fabricators of powdered metal. Reese Metal Products Corp. was the only establishment able or interested in tackling this problem with us."

Bonney now uses Remet shifters in seven of their ratchets. The sintered Remet parts are copper infiltrated iron.

More and more design and production men each year rely on Remet services to help solve problems.

FREE BROCHURE "How to Cut Precision Parts Cost with the Remet Powdered Metal Process" shows how the Reese Corp. can help you. Send for your copy today.

Remet

REESE METAL PRODUCTS CORPORATION

537 Howard Ave., Lancaster 10, Penna.

Gears • Pinions • Cams • Ratchets
"Oilless" Bearings • Bushings • Machine and Structural Parts in
COPPER • BRASS • IRON • ALLOY STEEL • NICKEL SILVER • COPPER INFILTRATED IRON

For more information circle No. 65 on the Reader Service Card

BERYLLIUM CORP. TO STUDY EXTRUSION OF PURE METAL

Under a six months contract from Northrop Aircraft, Inc., THE BERYLLIUM CORP. will study the extrusion of pure beryllium rods and shapes for aircraft structural members.

The company has a 1700 ton Loewy extrusion press in its Reading mill used for extrusion of beryllium copper shapes, which will be used in the new studies.

Among the variables to be studied are lubricants, speeds, die design, temperatures. The corporation has been experimenting for some months on the extrusion of pure beryllium and plans to continue the present studies over the next several years even though the Northrop contract will end in the spring of 1959.

METAL MOLDERS FORM TRADE ASSOCIATION

THE METAL MOULDINGS MANUFACTURING ASSOCIATION was officially formed last December.

Eleven companies who had representatives present at the meeting at the Park-Sheraton Hotel in New York City, are charter members; they are: The B & T Metals Co., Columbus, O.; W. L. Bonnell Co., Newnan, Ga.; W. B. Huntzinger & Co., Zionsville, Pa.; The H. A. Leed Co., Hamden, Conn.; National Aluminum Co., Columbus, O.; New York Metal Moulding Co., Astoria, N.Y.; R & S Metal Moulding Industries, Memphis, Tenn.; Superior Industries, Inc., Youngstown, O.; Trim Alloys, Inc., Boston Mass.; Youngstown Mfg., Inc., Youngstown, O.

Mr. R. S. Inboden, vice president of B & T Metals Co. was elected president, Milton Smith, president of Trim Alloys, Inc. was elected first vice president and Ben Epstein, New York Metal Moulding Co. was elected second vice president of the new organization.

The Walter Gebhart Organization of Philadelphia will serve as executive secretary and treasurer for the new association.

STEARNS TO HEAD SALES OFFICE FOR FERRO CAST

The Ferro Cast and Electronics Divisions of the J. B. Rea Co., Inc. have opened a sales office in San Diego, Cal. The new office will be headed by Donald J. Stearns.

For top efficiency in tank cleaning

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 SERVICE MEN • OVER 160 MATERIALS

First choice in heavy-duty tank cleaning—hard-working Oakite "24"

Users everywhere agree that their best way to clean iron and steel parts is to tank-soak them in a hot solution of heavy-duty Oakite 24. This hard-working alkaline cleaner gets under the dirt layers and literally tears the soil from the surface. Despite excessive soil contamination of solution Oakite 24 maintains proper pH level and provides long, effective cleaning action.

Oakite 24 is but one of a wide range of alkaline tank-cleaning compounds. Others include medium and light duty oil and grease removers; self-emulsifying solvent cleaners specially designed for removing buffing compound residues, pigmented drawing compounds and other tenacious burned-on solid-particle dirts and smuts. Also available is a useful selection of materials for cleaning brass, copper, aluminum, magnesium, lead, tin and zinc.

Which is best for you? Only you and the Oakite man together can decide. It depends on your equipment, the parts you process, the next production step. Ask the Oakite man. From over 30 materials, you're *sure* to get the one cleaner that works most efficiently for you. Write for Bulletins. Oakite Products, Inc., 34G Rector Street, New York 6, N. Y.

it PAYS to ask Oakite

OAKITE

50 1909-1959 SCIENCE

years' leadership in industrial cleaning

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USEFUL LITERATURE, CATALOGS, MANUALS

any of these technical publications may be obtained by circling the numbers on the Reader Service Cards facing Page 108

PROCESSES

155 Ceramic Shell Casting — TURBO-CAST, INC. — Technical report on this process combining lost wax investment casting with ceramic shell molding.

156 Powder Metallurgy — REESE METAL PRODUCTS CORP. — Engineering report on powdered metal parts applications and designs.

157 Vacuum Die Casting — PREMIER DIE CASTING CO. — Brochure illustrates high pressure aluminum and zinc vacuum die castings.

MATERIALS & EQUIPMENT

203 Core & Mold Wash — MICHAEL SCOTT CO. — Technical data on SIB a core and mold wash for steel, iron and brass foundries. It can be used in the casting of any alloy.

159 Brass Alloys — BRIDGEPORT BRASS CO. — Technical report on the selection of the correct ultra fine grain size of brass alloys.

160 Solid Carbide Tools — ATRAX CO. — 148-page catalog and collection of engineering data on 1230 standard stock solid carbide tools.

161 Cooling Baffle — RICHARDS TOOL & MOLD CO. — Engineering data on the Type B-2 cooling baffle for cooling of sprue pin or cooling hot spots in dies where conventional water lines cannot be placed.

162 Induced Draft Fans — LEHIGH FAN & BLOWER DIV., FULLER CO. — 16-pages of engineering data on induced draft fans. Includes drawings, charts and specifications.

163 Colloidal Dispersions — ACHESON COLLOIDS CO. — Application data on colloidal dispersions for the die caster and permanent mold caster.

164 Retaining Ring — RAMSEY CORP. — Engineering data on plain or stainless steel single-turn retaining rings.

165 Sintering Furnace — NRC EQUIPMENT CORP. — Technical data on a high vacuum resistance furnace that will operate at temperatures as high as 2400 C.

166 Pure Chromium — CHROMALLOY CORP. — Technical report on Iochrome, a 99.997% pure chromium metal. Photos show fracture and fabricability characteristics.

167 Cemented Carbides — ALLEGHENY LUDLUM STEEL CORP. — 32-page catalog on brazed tools, carbide inserts, tool holders, and blanks.

168 Patternshop Equipment — KINDT-COLLINS CO. — 100-page catalog of patternshop, foundry and industrial equipment and supplies.

169 Brazing Furnaces — A. F. HOLDEN CO. — Technical report on atmosphere brazing and electrode-type salt bath brazing furnaces.

170 Investment Casting Patterns — J. I. HOLCOMB MFG. CO. — Engineering data on a synthetic, wax-like pattern material.

171 Tungsten Carbide — ADAMAS CARBIDE CORP. — 32-page catalog on tungsten carbide tools, tool tips, and dies.

172 Spring Steel — UDDEHOLM CO. OF AMERICA — 43-page engineering data booklet on Swedish cold rolled spring steel.

173 Die Casting Dies — DAMEN TOOL & ENGINEERING CO., INC. — Data sheet on company's facilities for exclusive manufacture of die casting dies and plastic molds.

Aluminum Bridge Railings — REYNOLDS METALS CO. — 26 complete drawings and specifications on aluminum bridge railings and accessories. Write on letterhead to Dept. PRD-5. Box 2346, Richmond 18, Virginia.

174 Iron Bearings — AMPLEX DIV., CHRYSLER CORP. — Engineering report on sintered self-lubricating iron bearings that are more economical than bronze and are suitable for many bronze applications.

175 Mold Spotting Press — PALFY DIE & MOLD CO. — Data sheets give specifications on the Bradwell mold spotting press.

176 Molybdenum Powder — METALS & RESIDUES, INC. — Technical report on a new process for the production of molybdenum metal powder.

177 Sintering Furnace — SURFACE COMBUSTION CORP. — 8-page technical report on heating and heat treatment of light metals in surface combustion sintering furnaces.

178 Air Valves — HANNIFIN CO. — 12-page technical discussion on air valves and their selection.

179 Spectroscopes — GAERTNER SCIENTIFIC CORP. — Technical report on spectroscopes for rapidly determing approximate material composition.

180 Heat Treating Furnaces — HEVI-DUTY ELECTRIC CO. — 12-page technical report on electric and fuel fired heat treating furnaces and protective atmosphere generators.

181 Millivoltmeters — MINNEAPOLIS-HONEYWELL REGULATOR CO. — 28-page technical manual gives specifications, features on non-control and control millivoltmeters.

Soldering Aluminum — REYNOLDS METALS CO. — Engineering manual contains the latest data on soldering aluminum. Write on letterhead to Dept. PRD-6, Box 2346, Richmond 18, Virginia.

FINISHING

182 Rotary Indexing Turret — HAMMOND MACHINERY BUILDERS, INC. — Technical literature on this machine that may be used with 1, 2, or 3 polishing, buffing, or deburring heads.

183 20-Inch Band Saw — ROCKWELL MFG. CO. — Technical data on a 20-inch band saw, with variable speed drive, that will cut stainless steel, aluminum, wood and plastics.

continued on page 87

Special Summary of Literature on Extrusions page 92

ACHESON

dispersions digest

Reporting uses for

dag® BRAND DISPERSIONS

COLLOIDAL DISPERSIONS OF GRAPHITE, MOLYBDENUM DISULFIDE, AND OTHER SOLIDS

'DAG' DISPERSIONS – THE ANSWER TO LOWER COSTS, BETTER CASTINGS

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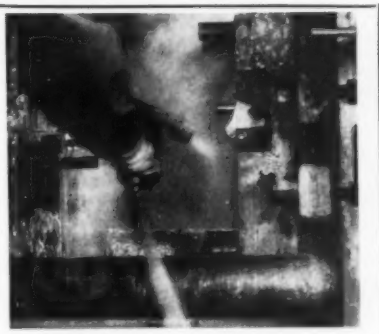
You'll find that Acheson processing methods produce dispersions of finer quality and more versatile use. Call your Acheson Service Engineer today for more specific information on the use of 'dag' dispersions. Or write direct for additional facts on " 'dag' colloidal dispersions for use in metal casting," Bulletin No. 425. Address Dept. PMM-59.



'Aquadag' finds ready acceptance by diecasters for its high temperature resistance, clean parting, and a smoother-surfaced casting.

Bendix finds 'Aquadag' a substantial cost saver. Rejects are down 30% at Bendix Foundries, Teterboro, New Jersey. Where surface folds, internal gas-induced porosity, and other not uncommon factors had previously caused a costly number of rejects in certain critical die-castings, Bendix now enjoys production advantages by using the Acheson water-based dispersion, 'Aquadag'. Used in casting magnesium jet-engine turbine blades and aluminum instrument components, the tough, dry lubricating film provides cleaner parting from the die. This film facilitates proper metal flow. It prevents the molten metal at 1250° F. from soldering to the steel die. It effectively resists the scrubbing action accompanying metal injection, where pressures are often as high as 30,000 psi. Proof of the inherent strength of this film is shown by the fact that one sprayed application normally lasts ten or more casting cycles. Die life is also appreciably extended. 'dag' Colloidal Graphite can play an important part in *your* casting operations . . . a lubricant that is non-volatile, chemically inert, and finely dispersed to provide complete coverage of the die surface.

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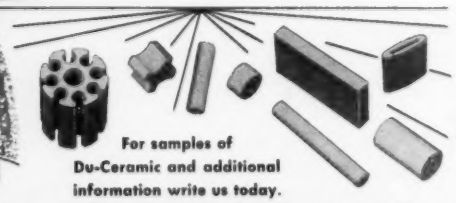

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USEFUL LITERATURE

continued from page 84

184 Hand Grinder — M-F ENGINEERING CO. — Data sheets on an air jet hand grinder that has a speed of 75,000 R.P.M.

185 Barrel Finishing Machine — UDYLITE CORP. — Technical data on a machine that offers flexibility, fully automatic control for all metal finishing processes.

186 Precision Cores — CORNING GLASS WORKS — Data sheet on Vycor Brand Tubing for forming precision diameter holes in high temperature metal castings.

187 Barrel Finishing Media — BMT MFG. CO. — Technical data sheets give specifications on precision barrel finishing media.

188 Abrasive Grain Coating — UNION CARBIDE CORP. — Technical report on A-1100 Silane coating for abrasive grains that increases grinding wheel efficiency 300%.

189 Buffing Cost Analysis — SCHAFFNER MFG. CO., INC. — The Buffing Cost Analysis Form let's you know what your compounds, buff usages and costs are.

190 Spray Booth Cleaner — NORTH AMERICAN MOGUL PRODUCTS CO. — Technical data on a cleaner that is effective in keeping water-wash spray booths in operating condition.

191 Chemical Milling — UNITED STATES CHEMICAL MILLING CORP. — Engineering report on the chemical milling of steel and "super" alloys.

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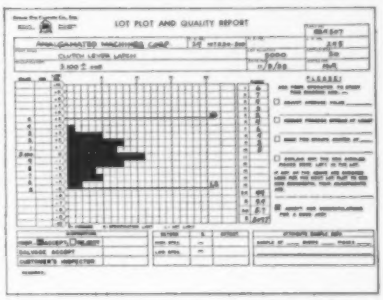

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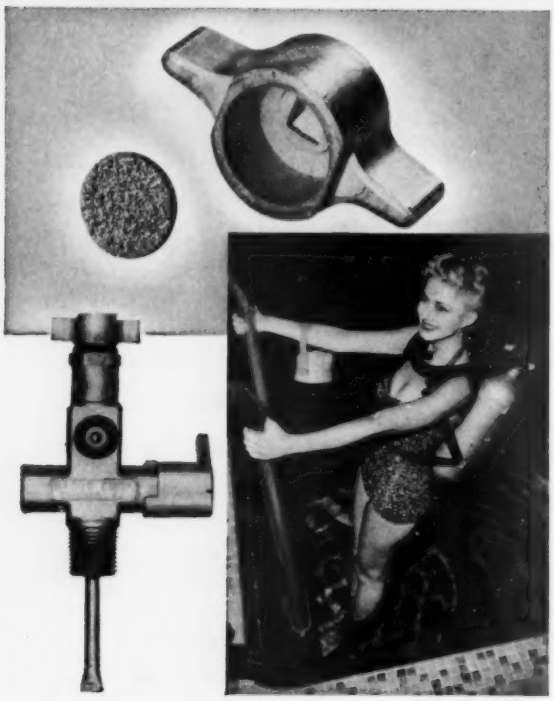

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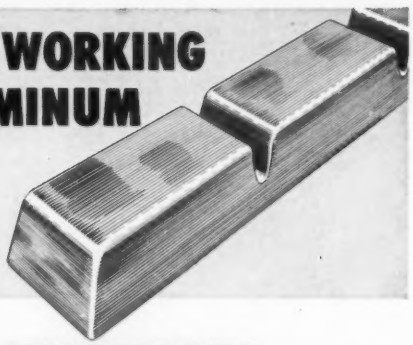

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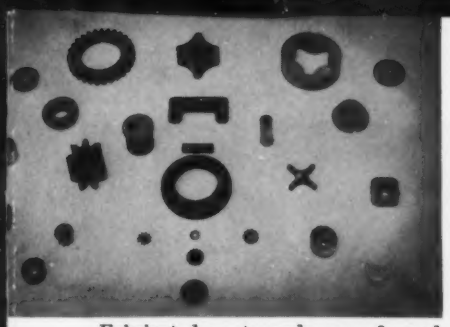
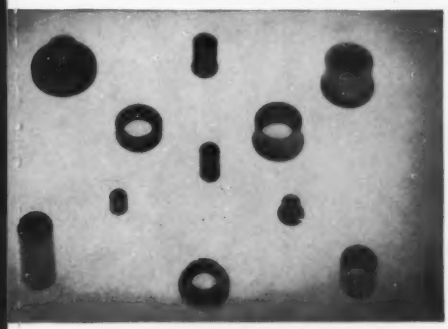
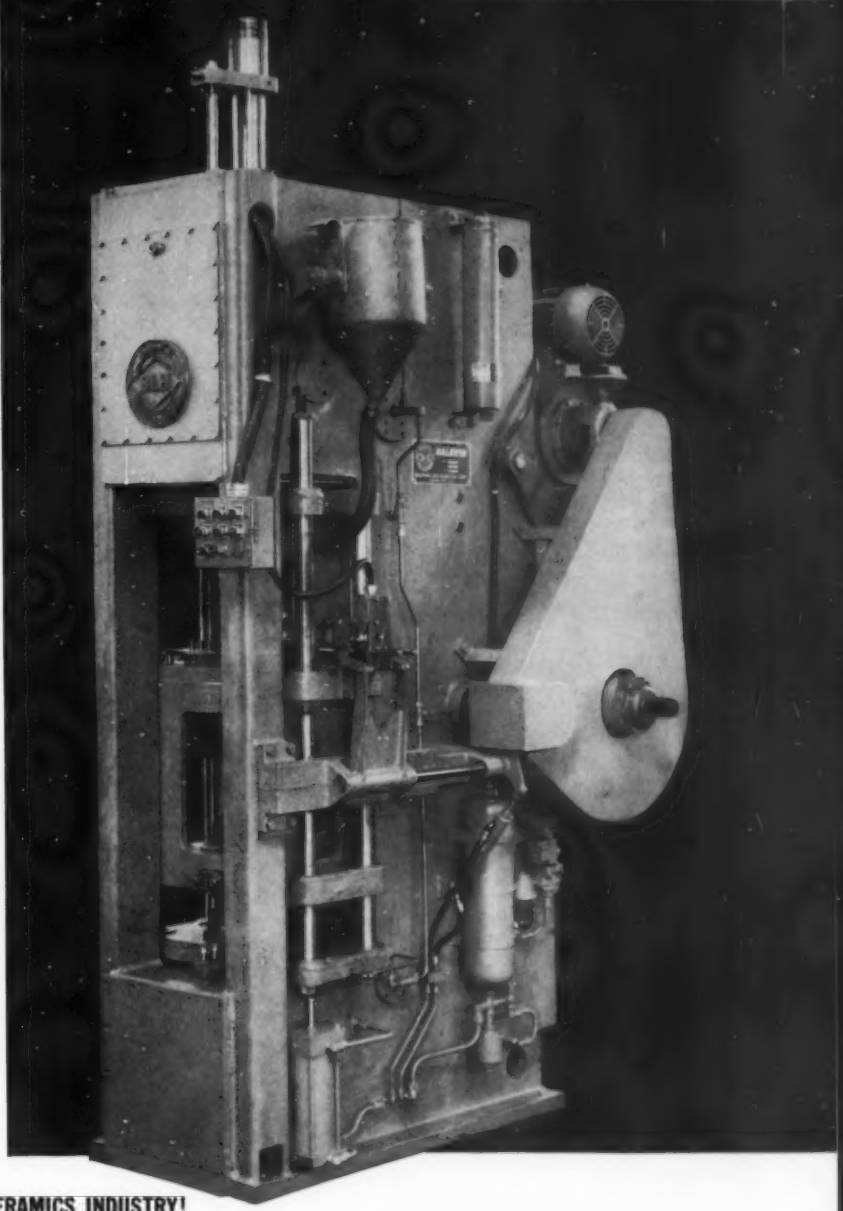


Fabricated parts and gears formed on Baldwin Compacting Presses.



Typical straight and flanged powdered metal bushings made on Baldwin Compacting Presses.

Other parts being made at United States Graphite on Baldwin presses. The double hub and counterbored parts are test pieces. Others are production items.



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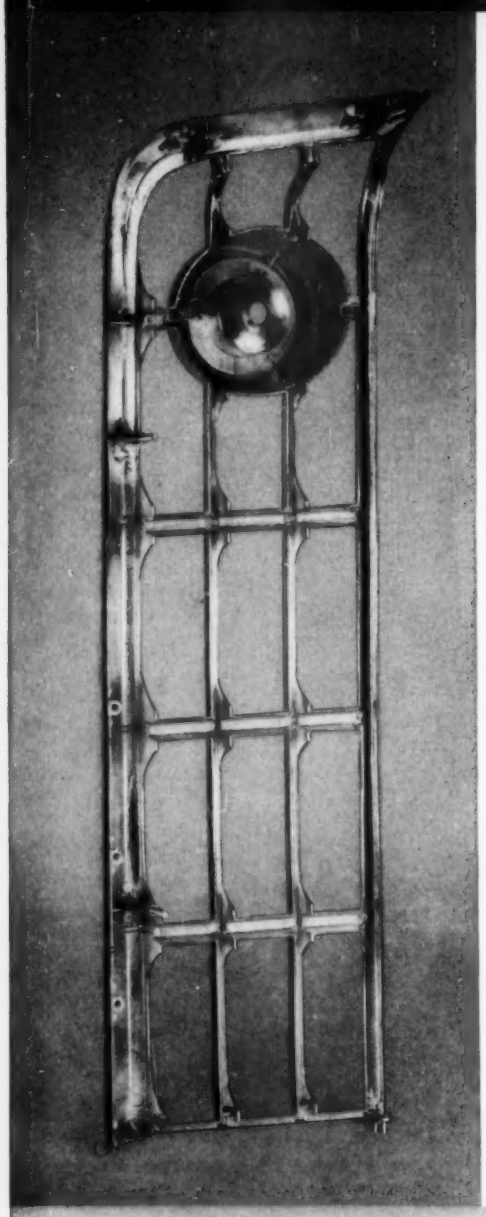

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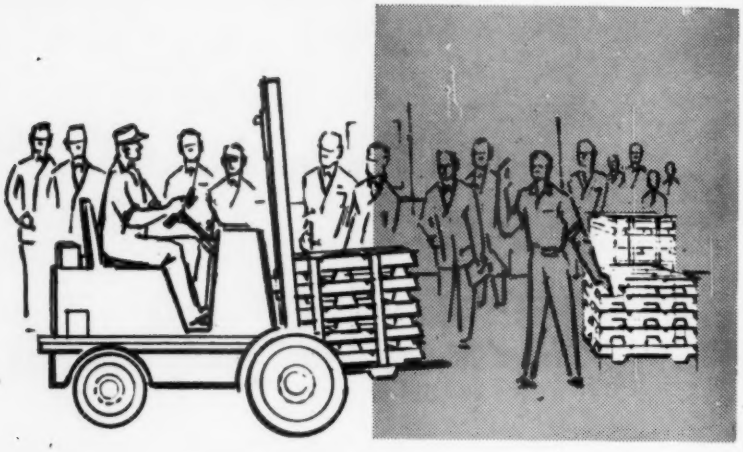
205 Straighteners — SUTTON ENGINEERING CO. — Technical data on straighteners for tubes and pipe, round bars, and flats and shapes.

206 Presses — SCHLOEMANN AKTIENGESELLSCHAFT — Data sheets on the company's steel tube and rod press. Controls, features and advantages are included.



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207 Dies — PMD EXTRUSION DIE CO., INC. — Bulletin discusses the company's facilities for producing all types of extrusion dies and tools.

208 Hollow Aluminum Bar Stock — HARVEY ALUMINUM — Technical report on hollow aluminum machining stock. Includes tabular data, on standard sizes available in round and hexagonal stock.

209 Extrusions — PRECISION EXTRUSIONS, INC. — Engineering report. Case studies on cost-cutting examples of aluminum extrusions. Includes solutions to design problems.

210 Presses — SUTTON ENGINEERING CO. — Data booklet No. 50 on hydraulic extrusion presses and other machines for processing metals.

211 Extrusions — TRIM ALLOYS INC. — Bulletin describes the company's integrated plant, from billet casting to die construction and post-extrusion fabricating.

212 Extrusion Tools — AJAX STEEL & FORGE CO. — 13-page technical report discusses the care of tools; containers, liners and rams. Each is described and the causes of damage listed. A list of precautions is included.

213 Impact Extrusions — IMPACT EXTRUSION PRODUCTS, INC. — Engineering report on cutting productions costs with aluminum impacts. Lists advantages of impact extruding.

214 Aluminum Extrusions — LIGHT METALS CORP. — Bulletin gives company's facilities for fabrication and assembly. Anodizing and silk screening are outlined.

215 Extrusions — PRECISION SHAPES, INC. — Engineering brochure illustrates extruded shapes. Lists tolerances attainable.

216 Equipment — WATSON-STILLMAN PRESS DIV., FARREL-BIRMINGHAM CO., INC. — Data sheets on a complete line of presses and hydraulic stretchers.

217 6,000 Ton Press — LOEWY-HYDROPRESS DIV. BALDWIN-LIMA-HAMILTON CORP. — Technical data on this press that can extrude billets up to 50″ long and 20″ in diameter.

218 Idea Kit — MIDWEST ALUMINUM CORP. — A sample handful of extruded shapes. This kit is intended for the designer to suggest an idea or two on the possible uses of extrusions.

219 Aluminum Press — BIRDSBORO STEEL FOUNDRY & MACHINE CO. — Technical data sheets give specifications on a 3,000-ton oil hydraulic press. Extrusion speed is up to 42" per minute.

220 Presses — WATSON-STILLMAN PRESS DIV. — Data sheets on aluminum extrusion presses in standard designs from 600 to 5000 tons.

221 Billet Heating — BAL-TATE FURNACE CO. — Engineering report on "Glass Baths For Heating Steel Extrusion Billets".

222 Aluminum Extrusions — SOUTHERN EXTRUSIONS, INC. — Engineering manual gives available alloys, mechanical specifications, and standard tolerances for aluminum extrusions.

223 Billet Heater — LINDBERG ENGINEERING CO. — Technical data on an induction billet heater that has a control system for heating billets to precise extrusion temperature.

224 Extrusions — JARL EXTRUSIONS, INC. — Data sheets list stock and standard solid, hollow and semi-hollow shapes for industrial applications.

225 Drafting Standards for Extrusions — ALUMINUM ASSOCIATION — 100-page engineering data book gives specific drafting practices that are necessary with extruded aluminum.

226 Press — BIRDSBORO STEEL FOUNDRY & MACHINE CO. — Technical data sheets on a self-contained, oil hydraulic, four-column press which has a 2,750-ton capacity.

227 Induction Heating — MAGNETHERMIC CORP. — Engineering manual on the extrusion of metals and low frequency induction heating.

11 Extrusions — BABCOCK & WILCOX CO. — Technical report on the Ugine-Sejournet hot extrusion process. Includes tabular data listing of extrudable alloys.

229 Extrusion Design — HARVEY ALUMINUM — 16-page technical manual on proper design for large extrusions.

continued on page 95

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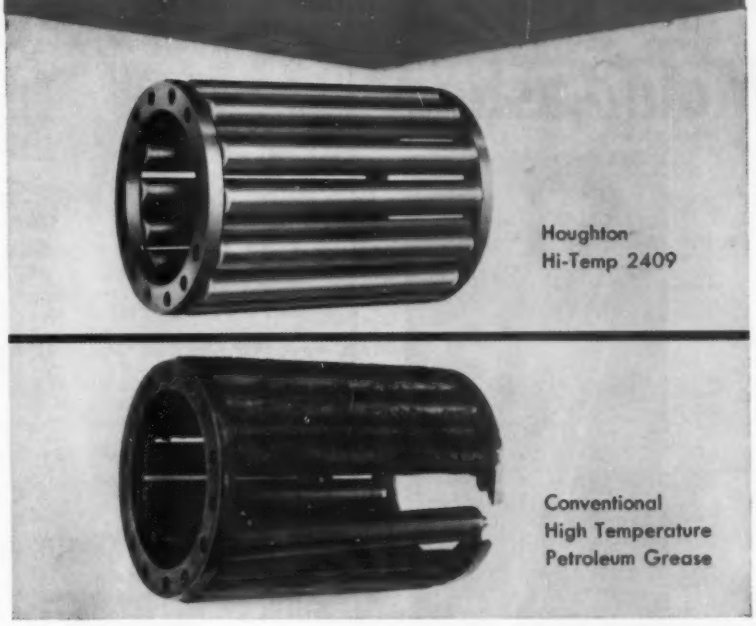

Bearing failure due to caking of carbon, de-composed thickeners, gums and resins at high temperatures can be prevented by use of Houghton's new Hi-Temp 2409 grease!

Hi-Temp 2409 represents a completely new concept in high temperature lubrication. In this new grease, *the thickener provides the lubrication—not the fluid!* No silicones, diesters, soaps, heavy metals or solvents are used.

A clean-burning synthetic fluid is used as a carrier. The grease becomes fluid at 200°F. carrying the lubricant to all bearing surfaces. At 500°F. the synthetic carrier is completely evaporated and a soft film of dry lubricant remains on the bearing capable of withstanding temperatures well above 1000°F.!

If you have a high temperature lubrication problem, it will pay you to investigate this new grease—Hi-Temp 2409. Call your Houghton Man for a demonstration or write E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa., for your copy of Houghton's new booklet on "Thermal Lubrication".

HIGH TEMPERATURE LUBRICANTS

HI-TEMP 2409 GREASE
HI-TEMP 100, 200, 300 SERIES OILS
COSMOLUBE 101 and 102
HOT FORGING AGENTS
DIE CASTING LUBRICANTS
PORCELAIN MOULD AIDS

products of . . . **E. F. HOUGHTON & CO.**

Ready to give you on-the-job service

Philadelphia, Pa. • Chicago, Ill.
Carrollton, Ga. • Detroit, Mich.
San Francisco, Calif. • Toronto, Canada

For more information circle No. 38 on the Reader Service Card

If you need strength—use a **Permanent Mold Casting**

This aluminum torque wrench frame needs the density and strength to be found in high grade permanent mold casting. In addition, the user receives the benefits of a fine finish and low cost.

We Welcome Your Inquiries

ECC

Eastern Casting

CORP. DIVISION

THE EASTERN MALLEABLE IRON CO.

69 South Williams St.

NEWBURGH, N. Y.

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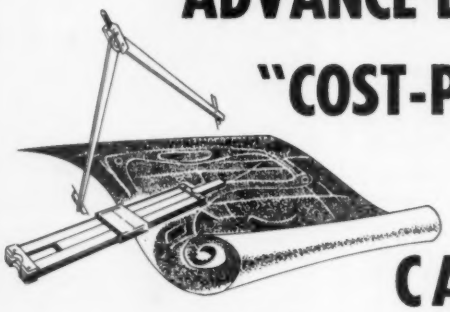
For more information circle No. 2 on the Reader Service Card

ADVANCE DESIGN for "COST-PLANNED" DIE CASTINGS



Advance Pressure Castings can take your product at any point in its development and carry it through to finished form. Every step of the way from blueprint to delivery of the finished product, your castings need the rich background of inventive engineering plus the custom-tooling and production facilities offered by Advance—and all at ONE SOURCE. Here, however simple or intricate the problem, you can depend on the finest skill and the greatest resourcefulness when fine zinc base or aluminum base alloy castings are involved. The best way to learn more about Advance Pressure Castings complete service is to discuss your casting problem with an Advance Development Engineer.

Send for literature and further details.

ADVANCE PRESSURE CASTINGS, Inc.

20-30 WYTHE AVE., BROOKLYN 11, N. Y.

"Sales Offices"

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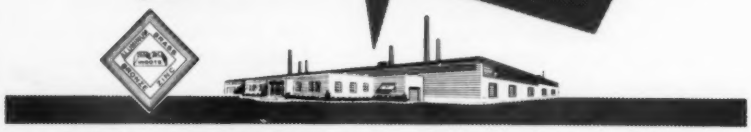
PHILADELPHIA, PA.
NEW BRITAIN, CONN.

DIE CASTING RESEARCH FOUNDATION PARTICIPANT

There's more castable metal in each "Sall alloy" ingot!

George Sall Metals' automated production process involves *three* separate refining operations . . . which result in the production of the "purest" nonferrous casting alloys that metallurgical research has yet achieved.

Depend on George Sall Metals "pure alloys" to minimize your metal loss.



THE GEORGE SALL METALS CO., INC.

2255 EAST BUTLER STREET • PHILA. 37, PENNA. • Pioneer 3-2828

PRODUCERS OF: Aluminum alloy ingot, Brass and bronze ingot, Zinc base die casting alloys

For more information circle No. 68 on the Reader Service Card

EXTRUSION LITERATURE

continued from page 93

230 Extrusions — PAX METAL CORP. — Bulletin tells how to improve production by using aluminum extrusions.

Stock Dies — WHITE METAL ROLLING & STAMPING CORP. — Catalog contains dimensioned diagrams of stock extrusion dies. Write on letterhead to: 92 Moultrie St., Brooklyn 22, New York.

231 Billet Peeling, Chipping — BLAW-KNOX CO. — 17-page engineering report on machinery for billet peeling and chipping.

232 Billet Coring — LOMBARD CORP. — Engineering report on semi-automatic coring of large extrusion billets.

233 Designing — REYNOLDS METALS CO. — 138-page engineering manual. Book gives basic principles that will enable the designer to use extruded shapes effectively.

234 Stretcher — LOMBARD CORP. — Data sheets on a 1500-ton stretcher for large extrusions.

235 Alloys — AMERICAN BRASS CO. — 5-pages of tabular data on the composition, and physical properties of extrudable alloys.

236 Copper, Brass Extrusions — REVERE COPPER & BRASS, INC. — 39-page engineering manual on copper, brass, and copper-base alloy extrusions.

237 Tube Extruding — AMERICAN BRASS CO.—Engineering data on the principle of tube extruding and the Mannesmann process.

238 Aluminum Extrusions—ALUMINUM CO. OF AMERICA—Technical bulletin on a 14,000-ton press and the range of extrusions it makes possible.

290 Extruded Products — REVERE COPPER & BRASS INC. — Bulletin gives data on the company's rod, bar and tube shapes.

291 Designing — JONES & LAUGHLIN STEEL CORP. — Technical report on designing steel shapes for hot extrusion and cold drawing.

292 Large Extrusions — ALUMINUM CO. OF AMERCA — Technical report on techniques and problems in large extrusion production.

continued on page 96

More and More Manufacturers are Installing

MARVEL SYNCLINAL FILTERS

AS STANDARD EQUIPMENT

Manufacturers of hydraulically actuated equipment and others with low pressure liquid circulating systems demand their equipment to perform consistently with all the productive efficiency they build into the machine that bears their name. Since these systems must be kept free of damaging particles, the selection of a filter is an important factor. Here are some of the outstanding reasons for the increasing preference for Marvel Synclinal Filters to do this all-important job!

SUMP TYPE (cutaway)

BECAUSE . . . Marvels are designed to give maximum ACTIVE filtering area rather than total filtering area. Only ACTIVE FILTERING AREA COUNTS!

BECAUSE . . . Marvels greater storage space for filtered out particles allows longer periods of "production" time at absolute minimum in maintenance cost and "down-time".

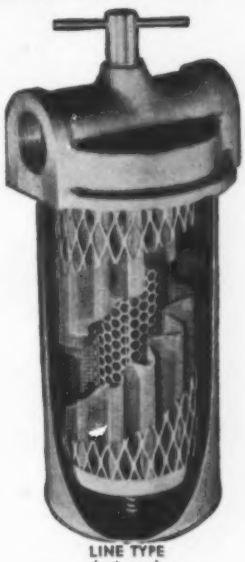
BECAUSE . . . Marvels can be disassembled, cleaned and reassembled by any workman in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connection.

BECAUSE . . . Marvels are protected and of sound construction to give long life and efficient filtration.

BECAUSE . . . Marvels (Both Sump and Line Type) are available in individual capacities from 5 to 100 G.P.M. and choice of mesh sizes ranging from coarse 30 to very fine 200, they get a filter to fit their specific requirements.

BECAUSE . . . Marvel not only delivers a top grade filter in both quality and performance, but delivers IMMEDIATELY—shipments are made the same day orders are received, if desired.

They Meet
J. I. C.
STANDARDS



LINE TYPE (cutaway)

FACTS—NOT CLAIMS

Engineers decide on the basis of the record, on the basis of measurable facts rather than claims of the "campaign promise" variety. Here is a fact with meaning—

OVER 800
Original Equipment Manufacturers Install MARVEL SYNCLINAL FILTERS as Standard Equipment

For Dependable Protection on All Hydraulic and Other Low Pressure Systems — investigate

MARVEL SYNCLINAL FILTERS

For further information write, wire, phone or use coupon

Catalogs containing complete data available on request

MARVEL ENGINEERING COMPANY
7227 N. HAMLIN AVE.,
CHICAGO 45, ILLINOIS
Phone: JUNIPER 8-6023

Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated:

- ☐ Catalog No. 108—For Hydraulic Oils, Coolants, Lubricants
- ☐ Catalog No. 200—For Fire-resistant Hydraulic Fluid (Aqueous Base)
- ☐ Catalog No. 400—For Fire-resistant Hydraulic Fluids (Synthetic)
- ☐ Catalog No. 301—For Water

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PMM-5

UCON
BRAND
HYDROLUBES

HELP

PROTECTION The fire-resistance of CARBIDE's fire-resistant hydraulic fluids has been proved by severe, exhaustive laboratory tests. And, in actual service, water-base UCON hydrolubes have prevented serious fires and injuries during more than 10 years of routine use in all types of industrial hydraulic equipment. The common fire hazards connected with hydraulic operations are eliminated when UCON hydrolubes are used. UCON hydrolubes are classified as acceptable, less hazardous fluids by Factory Mutual Laboratories.

ECONOMY UCON hydrolubes 150-CP and 275-CP are the economical answer to fire-resistance in hydraulic fluids. Most commercial hydraulic equipment can be easily converted to UCON hydrolubes with a minimum of time and expense. UCON hydrolubes have no harmful effects on most packings or seals. In fact, in many instances, reduced leakage losses have been reported. UCON hydrolubes also provide maximum protection against liquid and vapor phase corrosion and have outstanding anti-wear characteristics—thus, pump replacement costs are also held to a minimum.

Why not get all the facts on how UCON hydrolubes can mean protection plus economy for you. Write today for the booklet, "UCON Hydrolubes Spell Safety," F-40134.

UNION CARBIDE CHEMICALS COMPANY

Division of UNION CARBIDE Corporation

30 East 42nd Street, New York 17, N. Y.

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For more information circle No. 74 on the Reader Service Card

EXTRUSION LITERATURE

continued from page 95

293 **Impact Extrusions**—ALUMINUM CO. OF AMERICA—32-page engineering manual for the designer on aluminum impact extrusions and their method of fabrication.

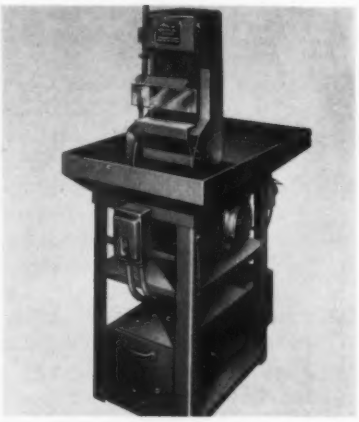
294 **Extrusions** — HARVEY ALUMINUM — Technical data on manufacturing limits of solid shapes, hollows, panels, and tube for heavy press extrusions.

295 **Extrusion News**—PRECISION EXTRUSIONS, INC. — "Extrusioneering News", helpful engineering data that is published 6 times a year. Contains application data, design tips, and the latest information on new extrudable alloys and their uses.

NEW PRODUCTS

continued from page 18

ABRASIVE BELT GRINDER



HAMMOND MACHINERY BUILDERS INC. — Model 600-P Abrasive Belt Grinder features precise water control which eliminates distortion and provides longer belt life. Also, the grinder can be furnished with a built in dust collector to be used as a dry unit.

Circle No. 243 on Reader Service Card

INGOT PROTECTION

ROTH SMELTING CO. — A Polyethylene film is being used by the company to protect aluminum and Zamac ingots from snow, rain, grease and dust. The tailor-made Poly covers fit snugly over each bundle.

Circle No. 244 on Reader Service Card

PORTABLE X-RAY UNIT

PICKER X-RAY CORP. — This portable industrial x-ray generator can radiograph 1¼ inches of steel in 45 seconds. The Andrex 140 consists of two parts: the 50 lb. generator and the 55 lb. control. The unit can be operated on practically any available power supply line.

Circle No. 245 on Reader Service Card

DRILLING & TAPPING HEADS

ETTCO TOOL & MACHINE CO., INC. — Knuckle-Head Model 400 is a small and compact fully adjustable 4-spindle drilling and tapping head for delicate production operations. It can operate in any position and will drill or tap from 2 to 4 holes ranging from 1/32" to ¼" in steel.

Circle No. 247 on Reader Service Card

continued on page 98

NOW by LITEMETAL
DIE CASTINGS IN ALL 3

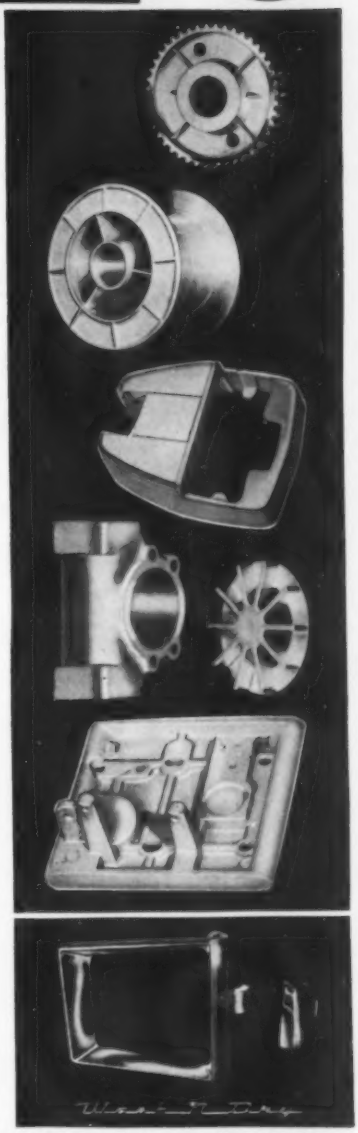
ALUMINUM · MAGNESIUM and ZINC

Our expanded facilities now establish LITEMETAL as one of the few companies actively producing Die Castings from Aluminum, Magnesium and Zinc. All departments are completely equipped with modern and powerful casting machines and trim presses. Zinc Die Castings are produced in a completely isolated building to prevent any possible alloy contamination.

To the right are shown a few of the wide range of products die cast by LITEMETAL for such diversified fields of manufacture as Chain Saws, Textile Spools, Office Equipment, Aircraft and Electronic Parts.

SERVICE • with • SKILL

Zinc Die Castings, shown in bottom panel, include a Refrigerator Handle, Control Knob and Script Nameplate. Additional facilities include plating and finishing to hardware standards. For example, through our affiliate, Namco Division of Hayes Industries, Inc., the handle was chrome plated, the knob and nameplate brass plated and lacquered to simulate gold . . . an integrated time-saving service, coupled with LITEMETAL skill and efficiency.



LD Small Enough for Intimate Service—Big Enough for Complete Service

Write today for literature and design information. Quick action on inquiries.

DIE CASTING RESEARCH FOUNDATION PARTICIPANT

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A SUBSIDIARY OF HAYES INDUSTRIES
1925 WILDWOOD AVE. · JACKSON, MICHIGAN
PLANT AND EXECUTIVE OFFICES

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For more information circle No. 50 on the Reader Service Card

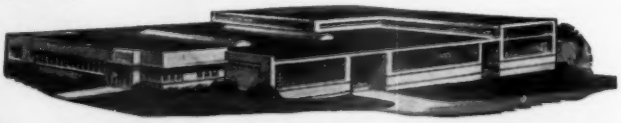
You can benefit by Milwaukee's 50 Years' Service to Industry

50th ANNIVERSARY 1909-1959

Since 1909, it has been the privilege of the Milwaukee Die Casting Company to work with manufacturers of a wide variety of products ... from mechanical pencils to airplanes ... in applying the die casting process to their problems of parts design and production. In those 50 years, Milwaukee has pioneered many of the developments which have since become standard practice.

If you wish to benefit by our 50 years of continuous service to industry coupled with the advantages of our modern die casting plant, we invite your inquiries.

Milwaukee operates under the Certified Zinc Plan of the American Die Casting Institute.



MILWAUKEE DIE CASTING COMPANY

4146 N. HOLTON STREET • MILWAUKEE 12, WISCONSIN

Established 1909

AS-5701

NEW PRODUCTS

continued from page 97

DETERGENT FOR METAL CLEANING

ROHM & HAAS CO. — Triton QS-15 combines detergent action with solubility in relatively high concentrations of alkaline cleaners. It also exhibits chemical stability in strong caustic. The compound is said to be 100% active ingredient, where other amphoteric detergents contain as much as 40% water.

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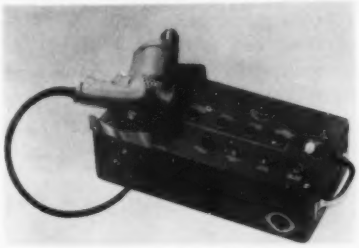
TOOL TESTER



POW-R-SAFE INC. — The tester is capable of almost automatically programming and testing AC portable tools, fractional h/p motors, etc. It will test for normal open circuit, ground and shorting.

Circle No. 249 on Reader Service Card

PICTURED ABOVE IS OUR MODERN SHOP AND OFFICES

exclusively devoted to engineering and building die casting dies and molds to exacting specifications. This plant was designed with capacities to handle and fabricate anything from a unit die insert to a 15 ton cylinder or grille die with the necessary skills and experience to save you time and money on your next tool.

RICHARD O. SCHULZ CO.

ELMWOOD PARK, ILLINOIS

•

DIE CASTING DIES • PLASTIC INJECTION AND COMPRESSION MOLDS

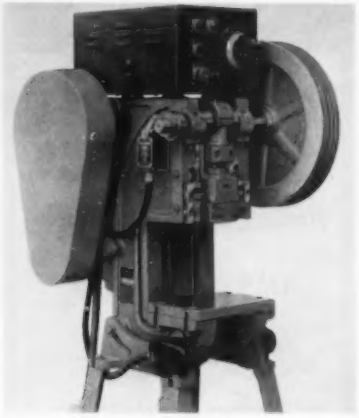
For more information circle No. 69 on the Reader Service Card

"INSTANT" EVACUATOR

VELVAC, INC. — The evacuator is a single stroke, double-acting, reciprocating piston type, actuated by an air cylinder. The single stroke direct action is fast making the unit ideal for producing vacuums in die cavities. It requires no reservoir tanks or accumulators and can be connected directly to the objects being evacuated.

Circle No. 250 on Reader Service Card

SAFE TRIM PRESS



KENCO MFG. CO. — 8-ton Electro-Safe press. To actuate the press the operator must depress two widely separated hand controls, and hold until the ram reaches the bottom of the stroke. This keeps the operator's hands out of the danger zone.

Circle No. 251 on Reader Service Card

INDICATING TEMPERATURE CONTROL

UNITED ELECTRIC CONTROLS CO. — Type E65N remote bulb indicating temperature controls are available in ranges between -100 and +450 F. The control is low in cost and is offered in skeleton form so it can be incorporated directly, or designed into equipment.

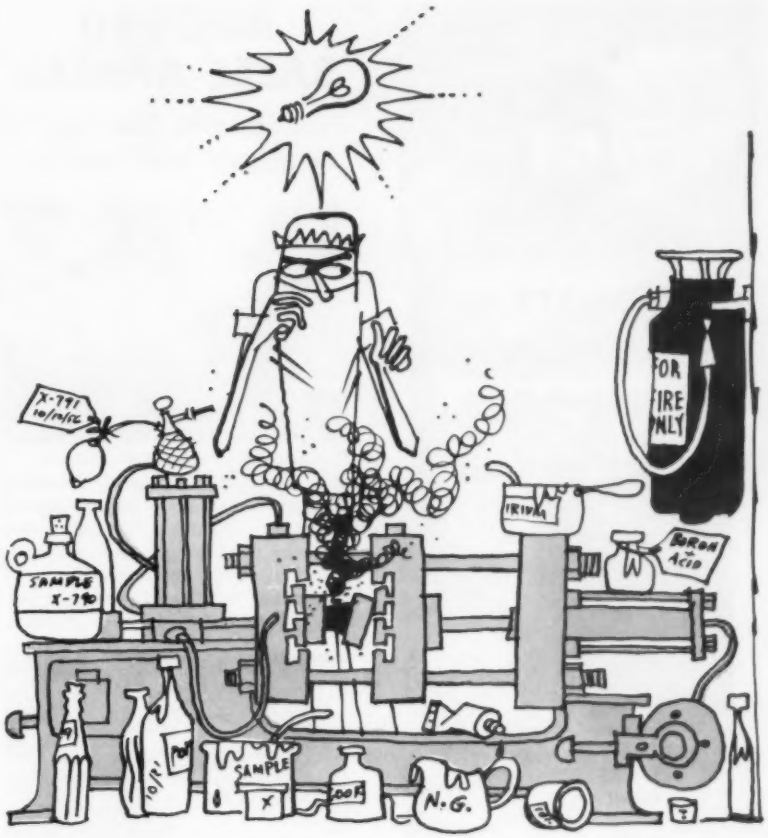
Circle No. 253 on Reader Service Card

CIRCULAR CHART RECORDERS

DAYSTROM, INC. — These recorder-controllers, with either electric or pneumatic controls, feature a constant voltage supply unit that eliminates batteries, standard cells, and standardizing mechanisms in potentiometers. Other improved mechanisms help to provide greater instrument reliability and service.

Circle No. 255 on Reader Service Card

continued on page 101



After impartial tests . . . try Die Slick!

New No. 44 Die Slick for aluminum die casting prevents sticking and soldering better than anything else tried, say leading die casters. No. 44 is the only compound that thins with water for regular jobs (eliminates smoke and fire hazard, reduces storage space) and thins with kerosene or solvent on tough jobs (bright clean finish, easy release).

Die Slick No. 44 is thixotropic – resists settling. When thinned with 3, 4 or 5 parts of water or kerosene it has the consistency of heavy cream, yet it brushes or sprays like water.

Try it thinned both ways. See why some shops have standardized on No. 44 Die Slick for all their aluminum die casting. Order a trial gallon today at our risk.

Die Slick is a registered trade mark of G. W. Smith & Sons, Inc.

DIE SLICK

used by die casters everywhere

G. W. SMITH & SONS, INC.,

1703 SPAULDING ROAD, DAYTON 3, OHIO

For more information circle No. 70 on the Reader Service Card

THE PIERCE-WALLER

AIR-LUBE SYSTEM

CUTS COSTS for DIE-CASTERS

- CLEANS
- LUBRICATES

Remove loose flash and clean the mold with a powerful, clean air blast — then lubricate all mold surfaces evenly, *using the same gun* —with a flick of the thumb! Adjustment *at the gun* for full range from zero to a heavy mist, spraying, fogging, or vaporizing the lubricant. Speeds up mold operation and reduces casting rejects. Makes every machine cycle count.

USED IN LARGE AND SMALL SHOPS EVERYWHERE!

WRITE FOR *FREE* FOLDER

PIERCE-WALLER, INC.
P.O. Box 2121A • DAYTON 29, OHIO

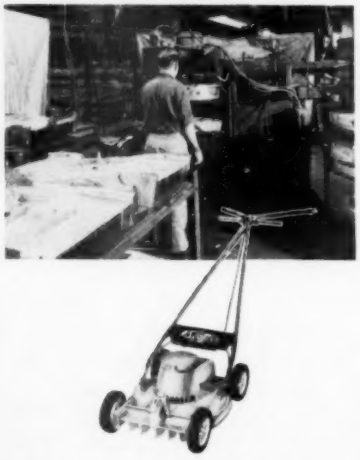
***Plant:* RAJAK MFG. CO.**
Specialists in polyester impregnation of metals
245 N. Fourth St. • Tipp City, Ohio

Circle No. 61 on the Reader Service Card

RUGGED SALES APPEAL

In Monarch Aluminum Permanent Mold Castings

Monarch's "One Source" analysis of their end-product casting requirements enabled O. M. Scott & Sons Company to compare all casting methods before freezing final design. Monarch engineers helped determine that aluminum permanent mold castings would produce the best end-product performance.



Monarch's extensive services in casting, machining and finishing provided completed castings ready for Scott's assembly.

This is a typical example of Monarch's approach to more casting value per dollar. It is underwritten by vast experience in mass-production of aluminum permanent mold, aluminum die casting, zinc die casting—machining and specialized finishing. For details how it works write for our new brochure—Today.

MANUFACTURING ACHIEVEMENTS in MOLTEN ALUMINUM

MONARCH ALUMINUM MFG. COMPANY
9205 Detroit Avenue Cleveland 2, Ohio

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PLAST-IRON POWDERS

REPLACE WITH

B-280
Standard 80 Mesh Iron Powder

IMPROVE WITH

B-281
Phos Enriched 80 Mesh Iron Powder

ECONOMIZE WITH

B-270
35 Mesh Reduced Iron Powder

PM 9d

Send for Technical Data and Working Sample

PM PLASTIC METALS

PLASTIC METALS
Division
National-U.S. Radiator Corporation

3459 BRIDGE STREET
JOHNSTOWN, PA.

Circle No. 55 on the Reader Service Card

NEW PRODUCTS

continued from page 99

HIGH VACUUM PUMPS

ROCHESTER DIV., CONSOLIDATED ELECTRODYNAMICS CORP. — The PMC line of oil diffusion high-vacuum pumps features speeds up to 138% higher than attainable with conventional pumps of comparable size. The 4" model will pump at a max. speed of 720 liters per second over the low pressure range from 2×10^{-5} to 2×10^{-3} mm Hg, with a limiting forepressure of 0.5 to 0.6 mm Hg.

Circle No. 252 on Reader Service Card

ULTRASONIC CLEANERS

GULTON INDUSTRIES, INC. — A line of industrial ultransonic cleaners that feature modular design and high temperature ceramic transducers. Five separate tank sizes and six preset generators, can be combined for specific applications based on the volume and number of pieces to be cleaned. Three different cleaning ranges, light, average, and heavy are available.

Circle No. 257 on Reader Service Card

continued on page 103

For more information circle No. 41 on the Reader Service Card

SELLERS OF

'METALKAT'
BRAND ELECTROLYTIC ZINC

SPECIAL HIGH GRADE 99.995% +
HIGH GRADE 99.95%

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Serving the Die Casting Industry

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AND NOW A

COATED THERMOCOUPLE TUBE*

has been added to OUR LINE OF ENGINEERED PRODUCTS:

Goosenecks, Nose Inserts, Plungers, Piston Rings, Plunger Couplings, Nozzles, Machine & Breakdown Pots.

Shot Sleeves, Plunger Tips, Plunger Rods.

Complete rework service on goosenecks, plungers, shot sleeves and plunger tips.

R·B For All Types & Sizes of Die Casting Machines

Rex-Buckeye Co.

*This tube has been immersed in aluminum over 1000 hours with no evidence of destruction or failure.

ATlantic 1-6718
2109 W. 41st ST., CLEVELAND 13, OHIO

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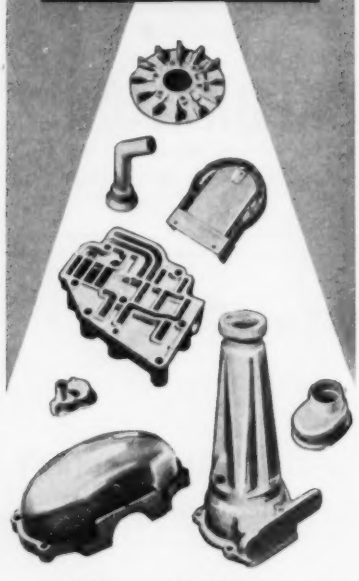
Paramount

YOUR BEST SOURCE



Flexibility

. . . a by-word with PARAMOUNT

Large castings, small castings, varied shapes and sizes . . . thin walls, combining strength and rigidity . . . close tolerances that eliminate machining — are every day routine at PARAMOUNT.

Our designers, sales engineers, plus modern tooling and production facilities are available for your complete die casting requirements.

WRITE FOR FREE DESCRIPTIVE BROCHURE

ALUMINUM ZINC MAGNESIUM

Paramount DIE CASTING COMPANY

St. Joseph 22, Michigan

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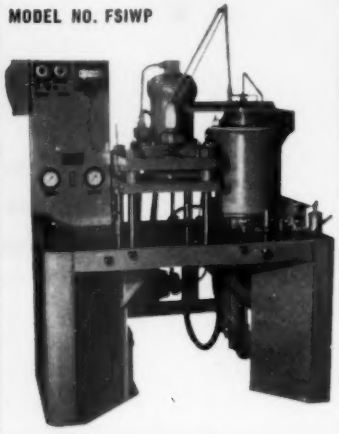
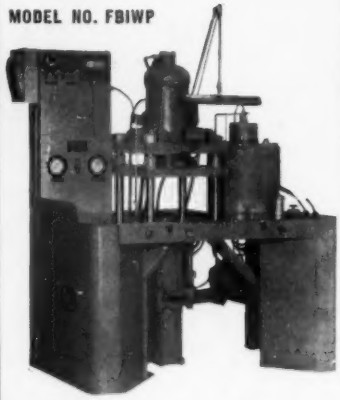
LEYDEN WAX INJECTORS

3 OF OUR MOST POPULAR MODELS

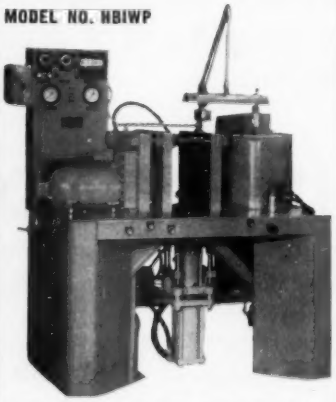
MODEL NO. FSIWP



MODEL NO. FBIWP



MODEL NO. HBIWP



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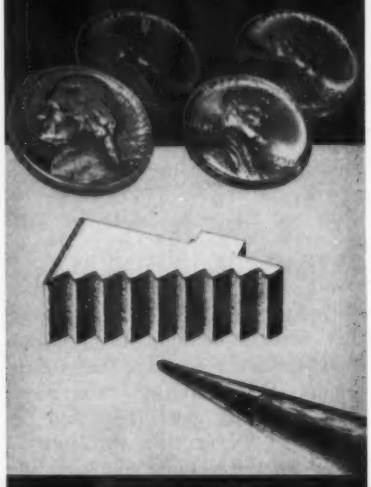
Any Type or Size Unit Built to Your Specifications.

LEYDEN HYDRAULICS, INC.

1800 North River Rd. • Melrose Park, Ill.

Only 8 Cents

. . . for this intricate Minicast part . . .



in quantities of 100,000

Here is another dramatic example of the benefits to be gained from the new Minicast precision process. In addition to an unusually low per unit cost for the part, strict specifications had to be met.

For example, the Minicast process had to provide

- an average maximum radius of .003 on the teeth
- specific tolerances of plus or minus .001
- no tolerance greater than plus or minus .003
- and produce the parts in non-machinable stellite

If you use intricate parts in similar quantity ranges, chances are the Minicast process is your answer to lower costs.

Write for this free brochure.

Casting Engineers DIV.

2325 NORTH BOSWORTH AVENUE CHICAGO 14, ILLINOIS

Circle No. 17 on the Reader Service Card

NEW PRODUCTS

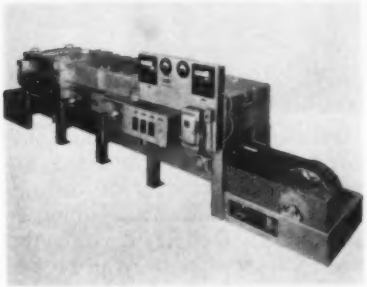
continued from page 101

PORTABLE SOLUTION FILTER

SEL-REX CORP. — The Pre-Met portable solution filter uses a rotating magnetic field to drive the enclosed pump impeller. This eliminates seals or stuffing glands, and produces a leak-free unit. The solution being filtered is in contact only with corrosion-free materials.

Circle No. 254 on Reader Service Card

ELECTRIC FURNACE FOR FIRING OF SILVER



TRENT, INC. — The furnace is designed for firing of silver ceramic components. It features tight controlling of temperatures and atmospheric conditions. The unit is divided into 6 sections: a 1′ loading zone, three 2½′ heating zones, a 3′ cooling zone and a 2′ unloading zone.

Circle No. 256 on Reader Service Card

COATED ABRASIVE DISCS

ABRASIVES CO. OF AMERICA — Magnecoating, a magnetic orientation of abrasive particles that provides up to 200% longer life, 2 to 4 times greater particle density, and more efficient cutting, is the process used in the manufacture of a new line of coated abrasive discs.

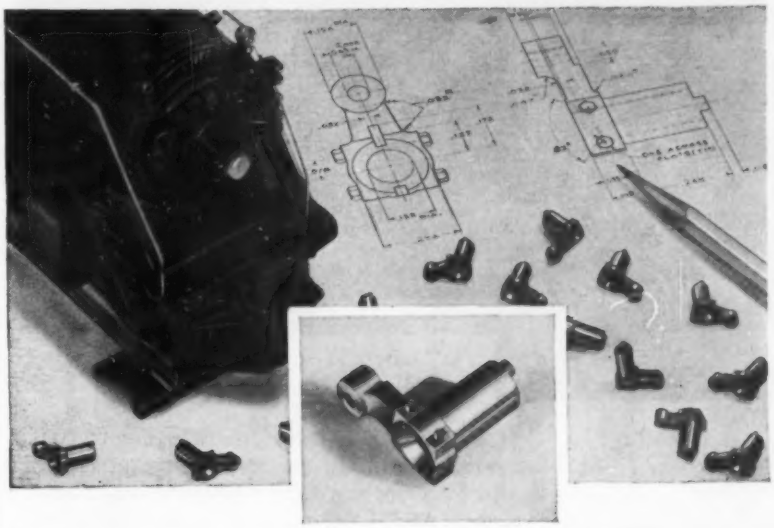
Circle No. 258 on Reader Service Card

VACUUM METALLIZING UNIT

NRC EQUIPMENT CORP. — A versatile bell-jar metallizing unit. Uses

continued on next page

GRC DIE CASTING HELPS LIONEL ACHIEVE TINY PART AUTHENTICITY



Tiny, intricate, too costly to make in their own plant, GRC's specialized techniques made this Toy Crank economically possible

While it would seem more advantageous for manufacturers to make all parts in their own plants, some have found that a specialist can do it cheaper, faster, and sometimes even better. This Lionel toy crank is an example. GRC specialized techniques made it possible for them to produce this tiny authentic part more quickly and more economically than Lionel could themselves. Die cast in zinc alloy in a single automatic operation, the cost of the GRC crank was little more than $5.00 per thousand in lots of 500,000.

Miniature in size, intricate in shape, this crank is typical of the many small parts problems economically solved by GRC. It is typical too of the close tolerances and uniformity achieved by Gries' fully automatic methods. Whether simple or complex, quality is high — no secondary operations, no scrap loss. GRC parts leave the machines ready for immediate use.

If you have a small parts problem, need flexibility in design, write for Gries' informative bulletins on **Zinc Alloy Die Castings and Injection Molded Plastics**, or send prints for quotations. There is no minimum size. Maximum: 1¾" long, ½ oz. in zinc alloy; 1¼" long, .03 oz. in plastic.

Washer base wing and cap nuts in die cast zinc alloy now cataloged by GRC

Save inventory, assembly time, and labor, with these wide-diameter washer base nuts. Eliminate separate washers. GRC offers prompt delivery from stock in a complete range of 14 thread sizes: #6 through ⅜". Specially suited for oversize bolt holes, adjusting slots, soft surfaces.

GRC nylon nuts and screws, wire ties and clamps, now available from stock

New nylon hex nuts in ten sizes (#2 thru 5/16"). Coil bobbins in a wide range of shapes and sizes — from ¼" diam. x ¼" long to ⅞" diam. x ⅞" long — in round, square, rectangular and oval shapes. GRC's specialized techniques help you take advantage of nylon's unique properties.

Yours for the asking —GRC HANDY GUIDE TO LOW COST QUALITY FASTENERS

WORLD'S FOREMOST PRODUCER OF SMALL DIE CASTINGS

GRIES

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Be sure to see GRC at the Design Engineering Show — Booth 1524

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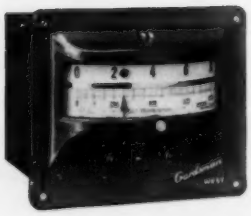
If temperature is a factor in *any* step of your overall operation, quality of its control can affect *several* steps far more than you might expect. And, from our experience with countless applications that may be considered "satisfactory," control is rarely as good as it can be...

Temperature control can be more precise and consistent. It *can* reduce work-stoppage and rejects. It *can* increase volume and maintain quality. It *can* simplify some steps and materially cut costs.

Use the know-how of our world-wide service force to evaluate your potential in temperature control. Free consultation plus complete selection of instruments to suit your individual situation—Veri-Tell Indicators, Gardsman Controllers, Marksman Recorders, our own Thermocouples and accessories.

Proportioning Controller



Gardsman Model JP (shown) automatically adjusts On-time to Off-time to maintain any desired temperature within extremely close limits. Wide selection of Gardsman controllers provides for all control applications. All are tubeless, "solid-state" and proved in wide use. Phone your West consultant (see Yellow pages) or write Chicago office for Bulletin JP or for COM digest-catalog of line.

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SALES OFFICES IN PRINCIPAL CITIES
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the trend is to **WEST**

Represented in Canada by
Davis Automatic Controls, Inc.

For more information circle No. 76 on the Reader Service Card

NEW PRODUCTS

continued from page 103

include developmental work or limited volume deposition of 1 or more materials under vacuum. The vacuum chamber is formed by a 30½" high bell-jar and a 28" diameter baseplate.

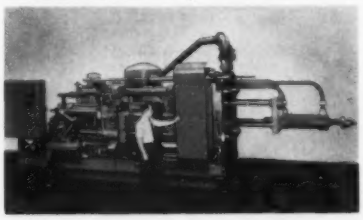
Circle No. 259 on Reader Service Card

STRAIN GAGES

TATNALL MEASURING SYSTEMS CO. — Strain gages for use on magnesium parts. They provide an extremely low coefficient of resistance. The 101 series is for use at temperatures from sub-zero to +200 F. The 100 Series is for use at temperatures to +500 F.

Circle No. 260 on Reader Service Card

600-TON DIE CASTING MACHINE



REED-PRENTICE DIV., PACKAGE MACHINERY CO. — Designed for all types of cold chamber die casting. Hand ladling, automatic ladling or automatic feeding through the Reed Vacufeed system can be utilized. It produces aluminum castings weighing up to 10 lbs. The die stroke is adjustable from 12½" to 18½". Die plates measure 47" x 46½", giving 28½" x 28" clearance between tie bars.

Circle No. 261 on Reader Service Card

SPINDLE TYPE FINISHING EQUIPMENT

TECHLINE DIV., WHEELABRATOR CORP. — Vertical spindle machines for precision finishing of parts which are not adaptable to conventional barrel finishing methods. Models incorporate 4, 8, and 16 spindles. Power drives range from 5 to 30 h.p.

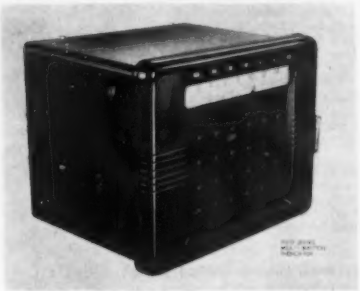
Circle No. 262 on Reader Service Card

STRAIGHT LINE CONVEYOR

DIVINE BROTHERS CO. — Universal straight line conveyor for use with Type V and L polishing, buffing and brushing heads. Standard loading section is 7' long, unloading section is 6' long. Intermediate

sections are made in 5′ and 10′ lengths. The conveyor is available in 4″, 6″, 10″ and 12″ belt widths.
Circle No. 264 on Reader Service Card

MULTI-SWITCH INDICATOR



BARBER-COLMAN CO. — The 9000 Series Multi-Switch Indicator, for rapidly checking temperatures at many points, is available with switching details that allow the instrument to be used for as many as 108 stations.
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FORMING GAS GENERATOR

C. I. HAYES, INC. — The Nitro-Form Gas Generator, Model FG-50, will produce 75 to 100% nitrogen atmosphere, 0-25% controlled percentages of hydrogen, at minimum dew point. Gas is saturated at 10° above cooling water.
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VAPOR DEGREASER

PHILLIPS MFG. CO. — The Phillips "Scotsman" is vapor degreaser that has a low initial cost and is economical to operate. It is light weight and portable, and can clean up to 300 lbs. of steel per hour.
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CORROSION PREVENTIVE

ENTHONE INC. — Entek-45, a liquid additive to hot water rinses that prevents spotting and corrosion of all metals. It can be used after plating, pickling, or chemical processing of any kind.
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SAFETY SWITCH FOR PILOT FLAME FAILURE

PARTLOW CORP. — Model SBS Safety Switch will automatically shut down both pilot and main fuel flow, in any gas-fired industrial heating operation, by actuating a solonoid valve. All fuel will be shut off in 30 to 45 seconds.
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Latrobe Die Casting Co.
Latrobe, Pennsylvania

Established 1918

For more information circle No. 44 on the Reader Service Card

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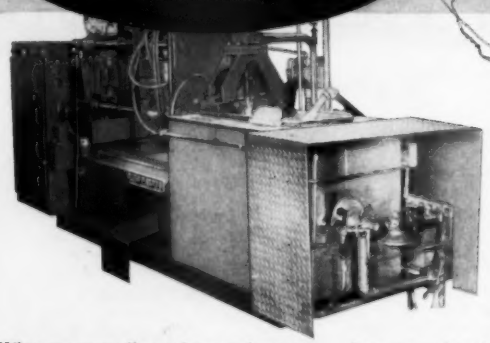
NOW!
IMPORTANT NEWS
to users of Small Castings

HAMPDEN BRASS ADDS NEW HIGH SPEED, FULLY AUTOMATIC ZINC DIE CASTING MACHINE

With the purchase of this new Zinc Machine, the capacity of our Zinc Section has been increased considerably. This is in keeping with our constant efforts to improve our facilities, thereby permitting us to serve our customers even better.



Whatever your die casting requirements . . . from a watch case to a car door, Hampden Brass is prepared to meet your specific needs . . . quickly, efficiently and to exacting specifications. Our sales engineers are always ready and prepared to assist you in any way possible.

2 New 1000 Ton Die Casting Machines Added Recently

A short time ago, we purchased 2 die casting machines of 1000 ton capacity . . . in addition to our 400 and 500 ton die casting machines. These machines, together with our new Zinc Machine, allow us to fulfill your aluminum and zinc die casting requirements . . . from the smallest to the largest size.

Send for brochure, "Behind the Scenes" . . . complete digest of Hampden Brass's experience, equipment and facilities.

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Complete Pattern & X-ray Lab Facilities

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DATA OFFERED IN THIS MONTH'S ADS

the Reader Service Cards facing the last page will get you these free reference materials. Circle the numbers and mail.

1. **Colloidal Dispersions** — for use in metal casting is the subject of a technical bulletin from Acheson Colloids Co.
2. **Die Castings** — Brochure on the company's "Cost-Planned" method of producing castings, from blueprint to delivery of the finished product. Advanced Pressure Castings, Inc.
3. **Dies & Related Tooling** — Technical literature on dies, hydrotels, pantographs, rotary head mills and jig mills. Alliance Mold Co., Inc.
6. **Sinterings** — Engineering Bulletin 3020 from American Sinteel Corp. gives technical data on ferrous and non-ferrous powdered metal products and their design.
10. **Investment Casting** — "Practical Guide to Investment Castings", is a 44-page design handbook from Arwood Precision Casting Corp.
11. **Extrusions** — Technical bulletin tells how job-matched extrusions can reduce the cost of finished products. Babcock & Wilcox Co.
13. **Compacting Press** — A low cost compacting press, designed for versatility and having a rated pressure of 50-tons, is described in technical literature. Hamilton Div., Baldwin-Lima-Hamilton.
15. **Sintering** —The "Engineering Handbook of Powder Metallurgy", and Catalog No. 58, which lists 2,227 sizes of completely finished cast bronze and sintered oil-filled bearings, are available from Bunting Brass & Bronze Co.
17. **Investment Casting** — with the Minicast process that can hold dimensional tolerances as close as plus/minus 0.001", is described in a technical bulletin from Casting Engineers, Inc.
22. **Die Castings** — Brochure from Di Salle Plating and Die Casting Co., presents a picture story on their facilities for making your specialized die casting.
23. **Die Casting Lubricants** — Technical literature on lubricants for all die casting purposes. The Die Casting "ID" Corp.
24. **Sprue Bushings** — sprue spreaders, ejector pins, and cavity retainer sets are described in literature from Detroit Mold Engineering Co. Complete specifications are included.
27. **Investment Casting Cores** — Du-Ceramic, a new material for investment casting cores, is described in technical literature from Du-Co Ceramic Co.
30. **Metal Working Lubricants** — for all methods of working aluminum and aluminum alloys are described in literature from Fiske Bros. Refining Company.
31. **Grain-Refining Compounds** — that will improve the physical properties of aluminum castings are discussed in a technical bulletin from Foundry Services, Inc.
32. **Eliminate Oxides** — dirt and other impurities from aluminum and zinc melts with Foseco Coverals. Technical bulletin from Foundry Services, Inc.
33. **Small Parts Problem?** — A solution might be found in informative bulletins from Gries Reproducer Corp. on small zinc die castings, injection molded plastics, and low-cost fasteners.
34. **Die Casting** — "Behind the Scenes" is a brochure from Hampden Brass & Aluminum Co. on their facilities for handling your aluminum and zinc die casting requirements.
35. **Mold Materials** — Technical information on mold wash materials, ceramic molding media, shell molding minerals. Harbison-Walker Refractories Co.
36. **Zinc Alloy Facts** — "Reference Book and Guide on Zamak (Zinc Base) Die Casting Alloys", from Henning Bros. & Smith, Inc. gives production and design data.
38. **High Temperature Lubrication** — Technical booklet on a lubricant capable of withstanding temperatures above 1000 F. E. F. Houghton & Company.
39. **Die Casting Machines** — Technical data on die casting machines available in 200 to 800-ton capacities. Hydraulic Press Mfg. Co.
42. **Sinterings** — Technical literature on Johnson Ledaloyl Powder Metallurgy for bronze or iron bearings, bushings, and parts. Johnson Bronze.
43. **Powder Metal Presses** — A complete line of hydraulic and mechanical models in capacities from 10-tons to 500-tons. Illustrated catalog. Kux Machine Co.
47. **Die Castings** — Design data from Litemetal Dicast, Inc. on aluminum, magnesium and zinc die castings.
51. **Investment Casting** — Technical data on the company's Mono-Shell process and castable alloys. Misco Precision Casting Co.
52. **Aluminum Castings** — Brochure explains the company's system of mass-producing aluminum permanent mold castings, aluminum and zinc die castings — and machining and specialized finishing. Monarch Aluminum Mfg. Co.
58. **Cutting Costs** — with brass powder metallurgy. Engineering data booklet evaluates this production method in terms of particular needs. The New Jersey Zinc Co.

continued on next page

Thousands of extra pours per ladle, with less effort for the operator
the Spincraft STAINLESS STEEL ladle
for non-ferrous metal pouring

LIGHT
TOUGH
LONGER-
LASTING

If you pour non-ferrous alloys, Spincraft ladles will save you replacement costs and make the job much easier. Designed to reduce operator fatigue by their lightness, balance, and non-spill shape, they resist burning-through as only stainless steel with its high critical melting point can do. Spincraft ladles come in 23 sizes, from ¼ lb. to 30 lb. molten metal capacity.

- 75% lighter than cast iron ladles
- Amazingly long life
- Shot-blasted for coating adhesion
- Deep conical form makes pouring easier, minimizes spillage
- Can be used for zinc and other metals without coating
- "Whack proof" handle arc-welded to reinforced cup edge
- Built to last longer, work lighter. Let your operator use one, then try to take it away from him!

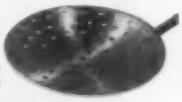
Complete handle on ¼ lb. through 9 lb. size; 10 through 30 lb. size has handle bracket stub to which proper length handle can be attached.

Also...Spincraft STAINLESS STEEL Skimmer

A skimmer that really skims! Shallow radius skims surface impurities instead of ladling as deeper-cupped skimmers do. Correct size holes prevent clogging. Short handle stubs fit common pipe and permit attachment of length and type handle you want.

IN FOUR DIAMETERS: 6 inch, 8 inch, 10 inch, 12 inch.

Spincraft ladles and skimmers are also available in low-cost mild steel.



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☐ Skimmers	☐ Skimmers

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NUCLEANT
grain-refining compounds

This bulletin tells you how. Send for your free copy today.

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2000 Bruck Street, Columbus 7, Ohio

59. **Aluminum Ingot** — Technical data bulletin on aluminum pig and ingot. Metals Div., Olin Mathieson Chemical Corp.

61. **Cleans, Lubricates** — That's what the Air-Lube System, manufactured by Pierce-Waller, Inc. does. Technical data sheets available.

62. **Vacuum Die Castings** — Literature on vacuum die castings and the Premier Die Casting Company's facilities for producing them to your specifications.

63. **Die Castings** — Brochure from Paramount Die Casting Co. describes their facilities for producing your specialized casting.

65. **Sintering Savings** — A technical report, "How to Cut Costs With The Remet Powdered Metal Process", is available from Reese Metal Products Corp.

71. **Stainless Steel Ladles & Skimmers** — which are 75% lighter than cast iron and have extremely long life, are described in technical literature. Spincraft, Inc.

72. **Statistical Quality Control** — for die castings. Technical literature from Stroh Die Casting Co., Inc. describes their use of quality control for lower inspection costs.

74. **Fire-Resistant Hydraulic Fluids** — "Ucon Hydrolubes Spell Safety", a technical report on laboratory tests. Includes service records. Union Carbide Chemicals Co.

76. **Proportioning Controller** — Technical bulletin on Model JP that automatically adjusts On-time to Off-time to maintain any desired temperature within close limits. West Instrument Co.

77. **Ultrasonic Cleaners** — Engineering data on cleaners that are built for performance and durability. Features the Multipower transducer which multiples the power and efficiency of ultra-sonic action. Acoustica Associates, Inc.

78. **Barrel Finishing Handbook** — 52-page engineering manual on barrel finishing. Includes case histories. Almco, Queen Products Div., King-Seeley Corp.

79. **Finishing Data Files** — Technical data files on metal finishing processes, equipment and systems, chemicals and supplies. Allied Research Products, Inc.

80. **Rubberized Abrasives** — 8-page catalog rubberized abrasives for deburring, smoothing and polishing tools, dies, patterns, molds, etc. Cratex Mfg. Co., Inc.

83. **Tank Cleaning** — Technical bulletins on cleaners for brass, copper, aluminum, magnesium, lead, tin and zinc. Oakite Products, Inc.

84. **Electrostatic Spray Painting** — Technical literature on the Ransburg No. 2 Process Electrostatic Hand Gun. Ransburg Electro-Coating Corp.

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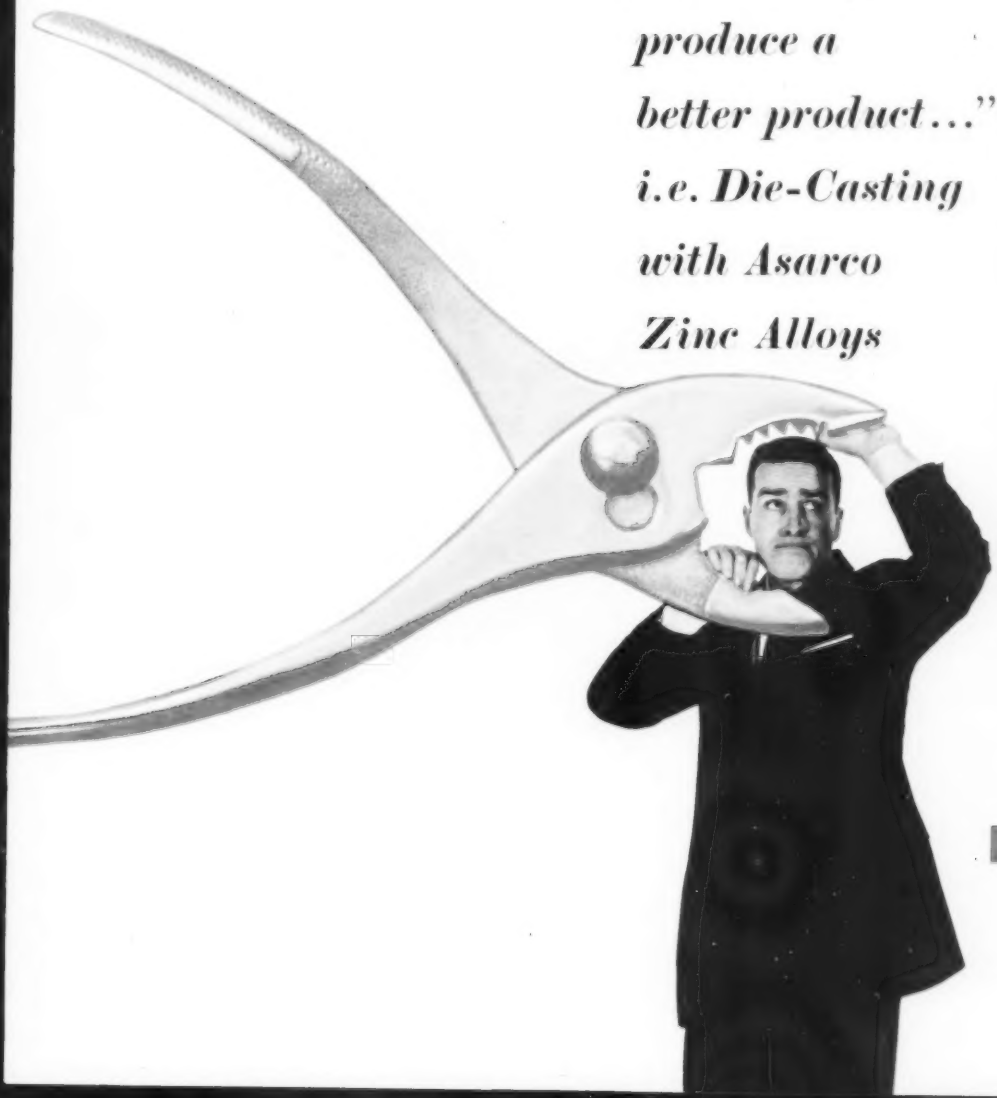
ASARCO

"the fast way out of today's profit squeeze is through the use of more efficient materials which cost less to machine and fabricate, yet produce a better product..."
i.e. Die-Casting with Asarco Zinc Alloys



SEE NEXT PAGE

Die-Casting with Asarco's Federate

Low machining costs, superior castability, and an excellent plating surface are the big reasons why Di-Metal castings are favored for fuel pumps, carburetors, grilles, lamp housings, instrument panels, horn rings, and many other functional and decorative automotive components.

Di-Metal castings make possible the faithful reproduction of detail that's so important in producing trains and other toy miniatures which look "just like the real thing."

The low cost, fine detail, complex shapes, and brilliant finish possible with zinc die-casting has become increasingly appealing to manufacturers of costume jewelry.

Di-Metal Zinc Alloys can cut your costs...and produce a better product in the bargain!

Every designer will sit up and take notice when he sees how easy it is to produce miniature objects with movable parts, even linkage, in one Di-Metal zinc casting. This is actual size of die-cast scissors.

Zinc die-casting provides the hardware field with the smooth cast surfaces so necessary in producing an attractive, lasting finish.

When gears, cams, hubs, and shafts can be integrally cast in one piece by zinc die-casting, a costly assembly operation is eliminated.

There's a big swing in metal parts production today to die casting with zinc—and it certainly makes good sense.

For one thing—Federated Di-Metal (alloyed from Asarco's Special High Grade Zinc 99.99 plus % pure) is lower in material cost.

But the big savings come in production. The low melting point of Federated Di-Metal cuts casting time to the bone. Die casting at lower temperatures calls for less expensive dies—and they last far longer.

Castings can be held to very close dimensional tolerances so that there's a minimum of machining and finishing. And even when this is necessary, highly ductile zinc is easy to work.

Die casting with Federated Di-Metal can produce the most complex shapes, the thinnest section walls, the smoothest casting surfaces. The castings have impact strength and other mechanical properties superior to other casting metals (with the possible exception of copper which, of course, costs more). And zinc die-castings can be readily electroplated or coated.

When you're both cost and quality conscious, you can't afford to by-pass die casting with Federated Di-Metal. It is proving the fastest way out of the present "profit squeeze" for a growing list of manufacturers in many fields.

When You Die-Cast Your Product with Asarco's Federated Zinc Di-Metal, You Profit from:

1. Integrated Production. Federated Di-Metal is alloyed using electrolytically refined Special High Grade Zinc from ores mined by Asarco. Alloys are produced "under one roof" at Corpus Christi, Texas, one of the world's largest electro zinc producing plants – assurance of highest purity and uniformity at lowest cost.
2. Nation-wide Service and Distribution. Always a Federated field engineer near you, on call from 23 sales offices throughout the country. Federated Di-Metal is stocked for immediate shipment from a nation-wide system of distribution centers.
3. Asarco booklets and bulletins of great working assistance to the die casting industry, detailing efficient working practices, selection of alloys, vital technical data. Write for your free copy of "For Better Die Castings," to your nearest Federated Sales Office or to ASARCO Federated Metals Division, 120 Broadway, New York 5, New York.

ASARCO

AMERICAN SMELTING AND REFINING COMPANY

Other ways it pays to THINK ZINC when you're cost-and-quality conscious:

GALVANIZED STEEL. The strength of steel, the corrosion resistance of zinc—at low cost. New processing methods assure uniformly thick zinc coating. Galvanized steel can be drawn or formed. Roofing and siding sheets for farm and industrial buildings are low in initial cost, installation cost, and maintenance cost. Corrugated culvert pipe is easy to transport and install, flexible, strong, durable. Galvanized sheets are superior materials in heating and air-conditioning installations—cost less, fabricate more easily, are more rigid for longer unsupported spans, operate quieter since they expand and contract less than comparable materials.

Zinc products available from Asarco:

ZINC SLAB, Prime Western, Brass Special, Intermediate, High Grade, Special High Grade;
ZINC ANODES for cathodic protection of ship hulls and other submerged steel structures;
ZINC DUST, 97% metallic zinc, 97% through 325 mesh screen;
ZINC FOIL for barrier wraps, insulation;
ZINC ALLOYS for die-casting.

Federated Sales Offices

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St. Louis phone: Jackson 4-4040

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Highland & Eastbourne Aves.
Phone: Orleans 5-2400

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Phone: Fairfax 2-1802

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Phone: Liberty 2-0797

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Chicago phone: Essex 5-5000
Whiting phone: Whiting 826

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Phone: Jackson 4-4040

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Phone: Empire 4-3601

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SEATTLE 4, WASHINGTON
101 Dakota Street
Phone: Main 3-7160

WHITING, IND. (CHICAGO)
123d St. & Indianapolis Blvd.
Whiting phone: Whiting 826
Chicago phone: Essex 5-5000

IN CANADA: Federated Metals Canada, Ltd.
Toronto, Ont., 1110 Birchmont Rd. Scarborough, Phone: Plymouth 7-3246
Montreal, P.Q., 1400 Norman St., Lachine, Phone: Melrose 7-3591

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If you want the kind of service featured in this cartoon, we aren't making any promises. But if you want service in quality aluminum and zinc alloy castings, you'll come to the right place if you come to Hoover. We've been satisfying the die-casting demands of many different industries for 35 years. Let one of our Sales Engineers tell you about us. Why not today?

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THE HOOVER COMPANY, Die Casting Division, North Canton, Ohio Die Casting specialists since 1922

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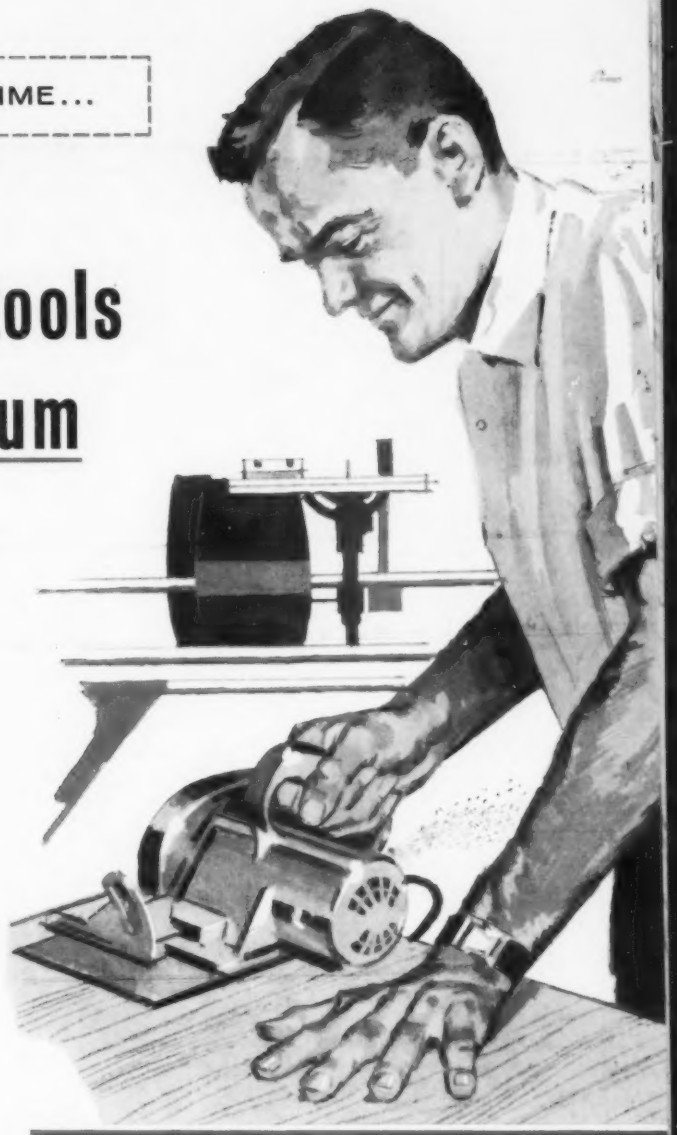
For more information circle No. 37 on the Reader Service Card

FOR A BETTER JOB IN LESS TIME...

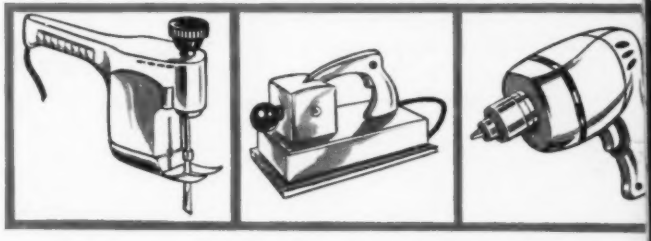
he's using power tools made with aluminum



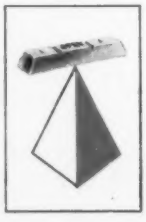
Today's homeowner is handier than ever and the professional works faster, delivers a better job—thanks to power tools and the versatility of aluminum. Whether you're sawing, sanding or drilling, these specialized tools provide the modern, easy way to finish the task.

Lightweight aluminum helps make power tools more portable, easier to handle. They give better service and last longer because aluminum is stronger. It's the one metal that resists rust, corrosion, pitting and chipping, always stays new looking. Too, manufacturers prefer aluminum because it can be formed in many ways, is easy to machine, and saves costly production steps.

Apex Smelting Company and its metallurgists work closely with the foundries and die casters who serve the power tool industry. Custom and standard aluminum alloys, scientifically produced by Apex to rigid specifications, are providing the performance and quality you want in these modern day work-savers.



Research leadership back of every ingot



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Producers of ALUMINUM, MAGNESIUM AND ZINC ALLOYS

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Your products may also be produced better and more efficiently with the help of aluminum castings. Apex Smelting and the companies it serves in the die casting and foundry industry stand ready to assist you and your engineers.

For more information circle No. 9 on the Reader Service Card